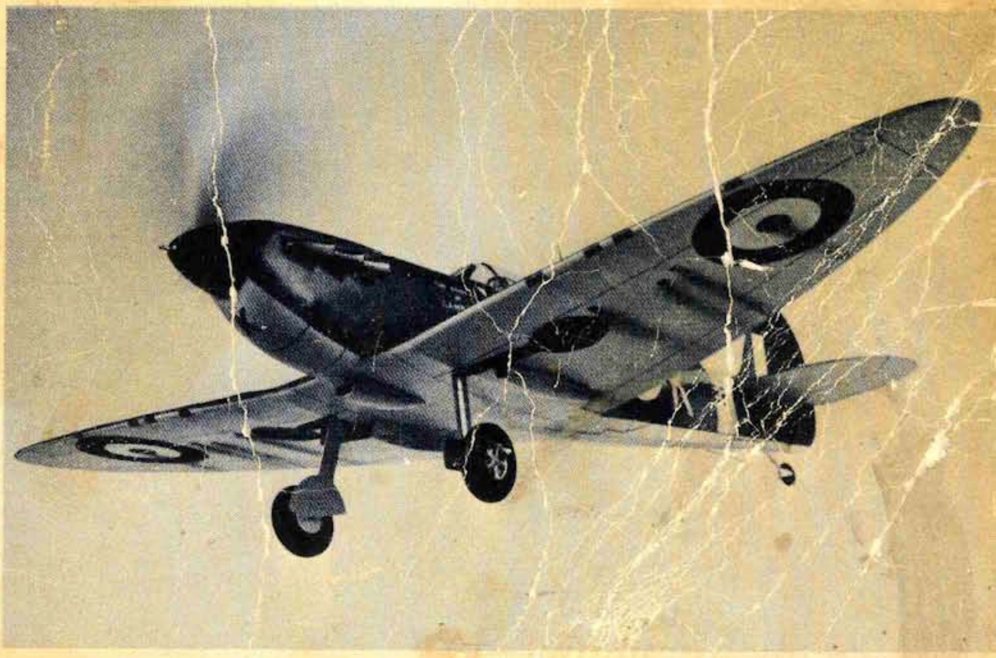
# FLYING SCALE MODELS OF WWII

# 12 FULL SIZE PLANS

- GRUMMAN F4F WILDCAT
- GRUMMAN F6F HELLCAT
- VOUGHT F4U CORSAIR
- MITSUBISHI ZERO
- HAWKER HURRICANE I
- SUPERMARINE SPITFIRE
- MESSERSCHMITT Bf-109E
- FOCKE-WULF TA-152
- BELL P-39 AIRACOBRA
- CURTISS P-40C
- P-47D THUNDERBOLT
- P-51B MUSTANG

- COVERING AND TRIMMING
- MAKING IT FLY
- BUILDING AND FINISHING



ALL 1/24 SCALE
(1/2"=1')

FEATURE ARTICLES ON BUILDING, FINISHING, AND FLIGHT ADJUSTMENTS.

# FLYING SCALE MODELS OF WW II

## FOREWORD

"Where were you when I needed you the most?" That's the thought that will go through your mind, if you are an accomplished modeler, as you leaf through the pages of this book and observe the beautifully executed full size plans . . . the carefully detailed and photographed step-by-step instructions on building, covering, and finishing . . . and the artfully contrived recommendations on how to trim and fly.

If you are not yet an accomplished modeler, but hope to improve your skills, let us hope this work comes to you in that period of time which is recalled above. Should that be the case, you are extremely fortunate. If, on the other hand, you have passed that early stage, it is not . . . and is really never . . . too late to be intrigued by the possibility of picking up some yet undiscovered tricks of the trade, such as; completely covering a round, compound curved fuselage with only two pieces of wet tissue!!

But . . . we're getting away from the main subject of the book; twelve beautiful WW II rubber powered scale model projects, with building instructions and full size plans.

Modelers who are known the world over for their ability to design, build, and fly free flight scale models, were especially commissioned to create the scale models published herein. Each was assigned one or more particular airplanes from WW II to model at 1/2" = 1'-0" scale. They were specifically instructed to stay as close as possible to the proportions of the real airplane, in outline and detail, yet at the same time, were to make whatever slight changes would be required to permit the models to fly well . . . without further deviations being required. After all, that was the object . . . *flying* rubber powered scale models.

All of the airplanes in this book were built and test flown prior to publication. In many instances, we were fortunate in obtaining photos of the models in actual flight. In *all* cases, there are photos of the uncovered structure, which will be of assistance during construction.

With each plan, the designer has provided a layout of sheet balsa parts which may be transferred directly to stock sizes of wood, and cut out. We would suggest obtaining an extra copy of the book so that you may cut out the plans and parts sheets, and still have a complete, unharmed copy to preserve. The plans have been arranged so that continued portions of wings and fuselages are not back-to-back.

World War II brought about the rapid development of military aircraft, and the designs offered here represent the cream, and nearly the last, of the propeller driven fighter era.

There are other great eras in aviation history that can be modeled with the same attention to outline and detail.

Perhaps . . . one of these days . . .

*Wm. C. Northrop, Jr.*

## CONTENTS



## CREDITS


**Compiled and produced by** ............... **I. E. COLEMAN**

**Edited by** ............... **Wm. C. NORTHROP, Jr.**

**Art Director** ............... **PAUL PLECAN**

**Published by** ............... **MODEL BUILDER Magazine**

**The rugged little F4F Wildcat was the only fighter available to the Navy and Marine Corps in the early months of WW II, and though not as fast or maneuverable as its prime opponent, the Japanese Zero, its brute strength gave it a final 7 to 1 ratio battle record.**

# GRUMMAN F4F WILDCAT

By HARRY A. BAGLEY, JR.

● The tubby, awkward, frog-like appearing little F4F Wildcat built by the Grumman "Iron Works" was the only fighter available in production quantities to the U.S. Navy during the first eighteen months of World War II. The sleek Japanese fighters could outclimb, outmaneuver, and run away from this portly barrel of sheet metal and rivets. However, the Wildcat redeemed itself by being structurally rugged, difficult to shoot down because of armor and self-sealing fuel tanks, stable and easy to fly, and able to outdive the Japanese fighters. The F4F could sustain as much as fifteen minutes of gunfire from the Zero, but could blast the enemy fighter out of the sky generally within six seconds after opening up with the four (or six) .50 caliber machine guns.

During most of the year 1942 and the first half of 1943, the scrappy F4F Wildcat won its greatest glory. In December, 1941, over Wake Island, U.S. Marine pilots got the Wildcat's first kills of the war. In the Battle of the Coral Sea, in May of 1942, the Wildcats effectively shot down at least 21 opposing carrier based aircraft in two days of fighting. At Midway, F4F squadrons helped to defeat the Japanese forces. For almost a year after June 1942, Grumman Wildcats helped break the back of the Imperial Japanese Navy in the Solomons campaign by ripping their aircraft out of the sky. The Battle of Guadalcanal was won because of the effective air cover provided by F4F's, so that U.S. dive-bombers and attack aircraft could do their telling work on enemy troops and installations. All in all, by the time it was replaced by later model fighters, the gutsy, beer-barrel F4F had a kill ratio of seven enemy fighters shot down for every Wildcat. Not bad for a "second rate" aircraft that turned out to be an unsung hero!

GENERAL DESCRIPTION

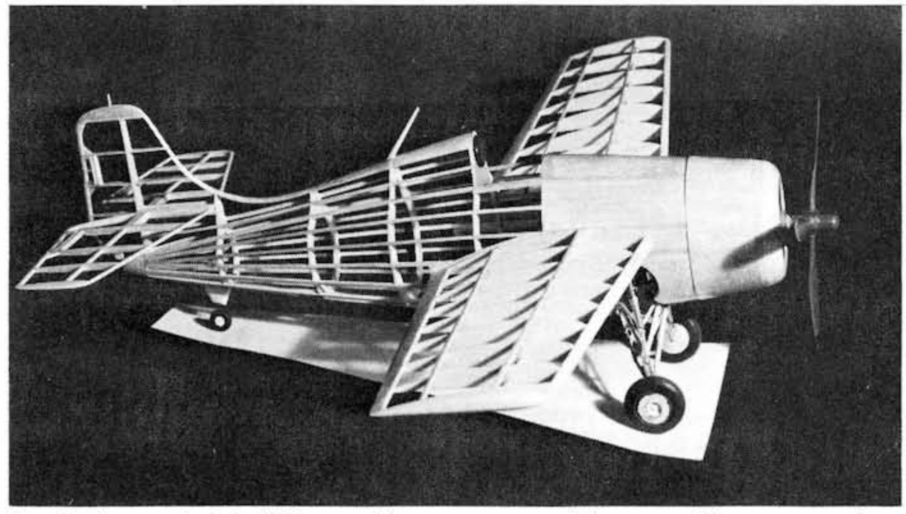
The model built and shown is one of the early production model F4F-3 Wildcats and does *not* have an external air scoop on top of the engine cowl. It also has only four machine guns in the fixed wings, and a long, straight type pitot tube in the left wing.

COLOR AND MARKINGS

This model depicts the specific aircraft of Commander James Thach of VF-3, as well as the general style of markings used on production Navy fighter aircraft during late 1941 and early 1942. You can find various other markings and coloration contained in the Profile publication of "The Grumman F4F-3 Wildcat," and an excellent booklet written completely in Japanese with terrific color renderings and photos titled F4F "???," dated 1971. This Japanese booklet is called the KOKU-FAN and is the January '71, Vol. 20 No. 2 issue. It is published by Bunrin-Do Company, Ltd. and can be obtained from Beaumont Aviation Literature, 11 Bath St., London EC1.

WINGS

The wing for this model is made up



**Even the framework of the Wildcat model seems more rugged than some of its contemporaries, however, with proper selection of materials, it need not be sluggish in performance.**

of two separate panels. Each panel can be completely built, covered and finished, then plugged into the finished fuselage.

First, cut all ribs from medium soft quarter grained sheet balsa. W-1 is 1/16 inch sheet and all other ribs are 1/32. Next, cut out and taper the leading and trailing edges from straight-grained medium soft balsa.

Place trailing edge and bottom front spar strip on top of plan in proper locations and fasten down. Fit ribs W-2 through W-9 in place and cement to trailing edge and bottom spar strip, making certain that all ribs are perpendicular to work surface. Allow cement to dry thoroughly. Place rear spar strip in notches on top of ribs, allowing extra length to hang over location where W-1 will be located, and cement to ribs W-2 to W-9. Install front top spar in notches in top of ribs and locate W-11 spar joiner accurately at ribs W-3 and W-2. Now rib W-1 can be located and set accurately in place between trailing edge and all spars.

Remove wing from board and install 1/16 inch strips and oil cooler platform. Cement leading edge and wing tip in place, and complete careful final sanding of all wing elements. Brush on two coats of thin dope (50% thinner to 50% dope) on the structure where covering tissue will be attached. Sand very lightly, then brush on a coat of full strength dope.

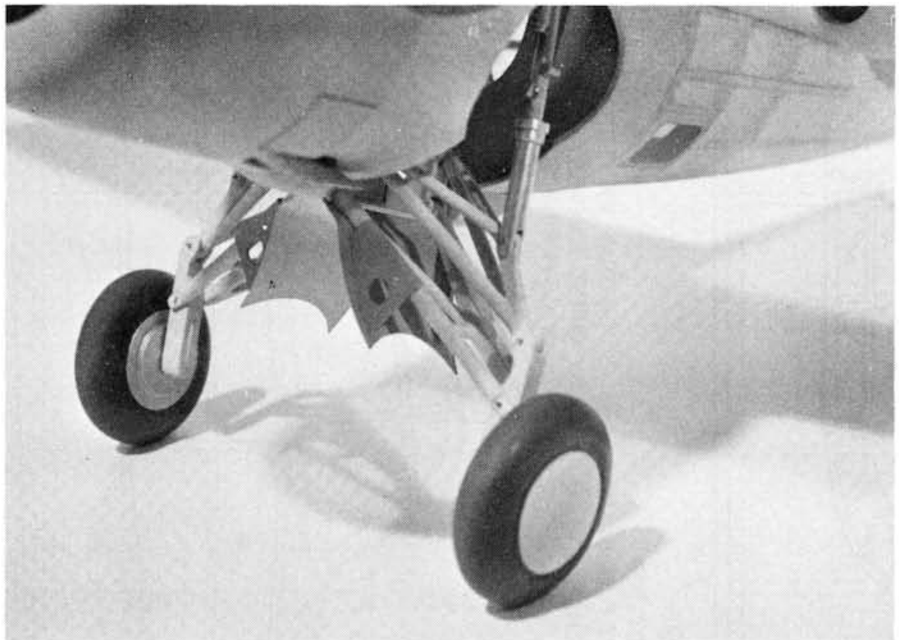
Covering each wing panel on this model is accomplished with standard blue Japanese tissue on the top surface, and white on the bottom. Apply only a light mist of water to eliminate possible warping. When wing is completely dry, spray or brush on two coats of thin clear dope. Add an adjustable tab to right wing (only) made from bristol board and thin copper wire for hinges. Color top and bottom to match wing.

HORIZONTAL TAIL SURFACES

These are made up of separate right and left panels in the same manner as the main wing. Each can be completely finished, then plugged into the fuselage vertical fin.

Much of the basic structure is cut from strips of 1/16 square balsa. The tips, trailing edges, and joining plates at centerline of airplane are all cut from 1/16 sheet to exact shapes shown. Add 1/32 thick by 1/16 wide cap strips to rib structures S-1 through S-5.

Cut 1/32 tip pieces to shape and cement to top and bottom of tips. Last, cut and cement 1/32 strips to top and bottom of trim tab intercostals between ribs S-3 and S-4 and top and bottom of plug-in boxes as shown. Now carefully sand the whole structure to a streamline airfoil shape. This is known as the "Stahl" type airfoil. Cover both panels in the same manner as the wing. Attach completed trim tabs with small, soft copper wire. Mark off control surfaces on main tail panels with India ink.



**The familiar retracting gear, first used on the F3F and earlier Grumman biplane fighters, is a complicated bunch of arms and pivots, which may be simplified if you intend to fly it often.**

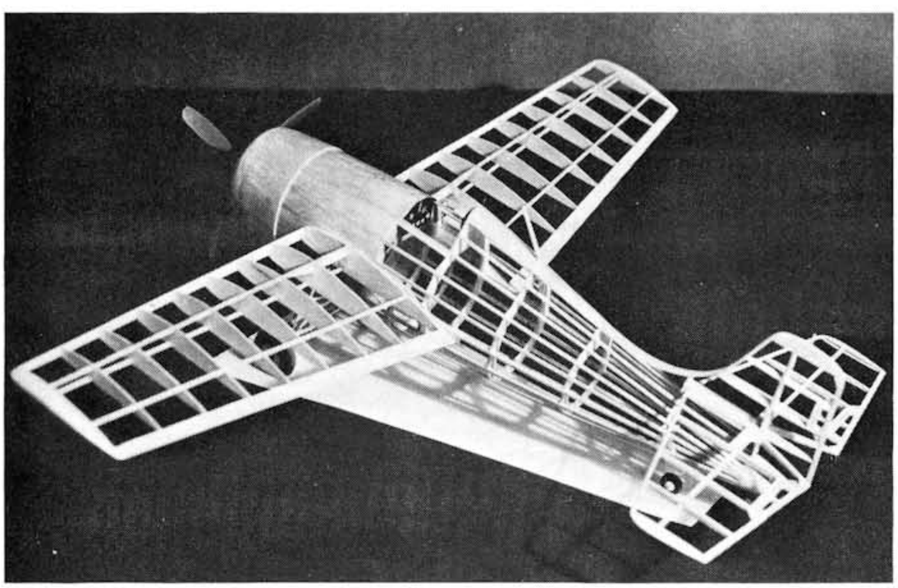
FUSELAGE

The fuselage structure shape for this model requires the building of the vertical tail furfaces as a part of the fuselage itself. The fuselage is of the half-shell type, complete with keels, stringers, and half-bulkheads.

Cut all bulkhead halves from quarter grained sheet balsa. Pin down the top and bottom keel pieces over the drawing. Note that portions of the fin and rudder are included in the half-shell structure.

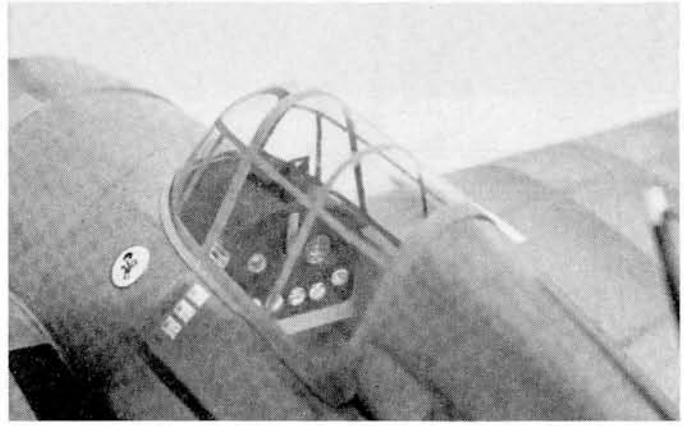
Cement the left side half-bulkheads F-2 through F-5, and F-7 through F-13 in place between top and bottom keels. Insert precut side keel F-18 in bulkhead notches and cement in place. Add top partial bulkhead F-6 between top and side panels as required. Install 1/16 square stringer that is located immediately above side keel F-17 and cement to bulkheads F-5 through F-9 only. Cement root rib piece F-19 in place after pre-trimming inside top edge to clear stringer just mentioned. Cement bottom piece of root rib, F-20, in place in area shown. Cut to length and install the 1/16 square horizontal tail support pieces between bulkheads F-12 and F-13. When dry, remove this left side assembly from the plan.

Lift the tracing of the plan, turn it upside down, and refasten to work surface. Invert the left fuselage assembly and set with top and bottom keels on 1/4 inch thick, 1¼ high by 1 inch wide spacer blocks mounted on edge at intervals around the plan. Check alignment, pin fuselage assembly to spacers, then proceed to add the right side half-bulkheads (also F-6B) and the amount of



**Wing and stabilizer panels are built separately, and may be completely finished before plugging into appropriate slots and glued. Inlaid 1/32 sheet is glued over bulkheads, between stringers.**

The author's model is decorated in the markings of late 1941, early 1942, with blue tissue on top, and white on the bottom.



A little cockpit detailing goes a long way toward improving the appearance of any scale model. Very little weight is added.

structure that has been added to the left side to this point. Remove fuselage assembly from the spacer jigs and add all other stringers to both sides alternately. . . except the side stringer immediately below the F-18 side keels.

From bulkhead F-4 through F-6, and F-6 through F-8, inset and cement trimmed pieces of soft 1/32 balsa between top keel F-14, and the first top stringer below and adjacent to it on each side of centerline. Inset and cement similar trimmed balsa pieces between same bulkheads on bottom of fuselage between same bulkheads on bottom of fuselage between bottom keel F-17 and first stringer above and adjacent to it on each side of centerline. From bulkhead F-2 to F-3, pieces of 1/32 soft balsa should be inset, trimmed, and cemented between all adjacent stringers and keels in the complete area under the engine cowl.

Cement the 1/8 inch bulkhead F-1 to F-3, including all inset pieces, to a smooth cross-sectional fuselage shape. Cut top and bottom engine cowl outer skin pieces from 1/32 sheet soft balsa, trim for accurate fit, and cement into position.

From small, soft pieces of scrap balsa, cut out and sand to rough shape the left and right sides of the tail cone. Hollow out both pieces for ultra light weight, and cement to F-13 and tail cone structure. Finish sand the complete tail cone to a smooth contour.

At this point, fit, trim and glue the 1/32 ribs in the vertical fin and rudder. Construct the trim tab, either from a single piece of very light balsa, or build up as shown on plan. Cement light, soft copper wire to tab for hinges, but do not attach to rudder at this time. Sand entire vertical tail including ribs, leading edge, trailing edge, and tip to final streamlined shape.

After cutting aft motor peg supports from 1/32" ply, cement to aft side of bulkhead F-12, top side of side keel, and the stringer above the side keel as shown on plan.

At this stage, the fuselage is ready for covering with Japanese tissue. Brush on a first coat of thin clear dope on all exterior surfaces of sheet balsa covering and all stringers and keels. After that, add two more coats of full strength clear dope. Sand lightly before the last coat. The fuselage is covered with strips of tissue running lengthwise, with a separate piece for each adjacent pair of stringers. When each piece of tissue is in correct position either on the stringers or on the sheet balsa, brush thinner through the paper to secure it. (For a unique method of covering with large pieces of tissue, see McHard's how-to article.) When shrunk and dry, brush or spray on two coats of thin clear dope over the entire outer surface of fuselage covering.

Cut, trim, and sand to fit, lower keel fairings in front and back of the wheel well location on either side of keel.

Form the lower V-struts for the landing gear from 1/32 wire to shape shown on plan. Insert into position in the bottom edge of lower keel, align, and cement securely to keel. The outboard free ends of the wire can be soldered or epoxied to the main landing gear wire strut which is already in position in the fuselage. All wire struts can be covered with plastic tubing or shaped balso to give realistic thickness to the struts. The wheel wells can be simulated by cutting pieces of black tissue to their exact shape, then attaching them to fuselage covering using thinner followed by a coat of clear thin dope. The small windows aft of the wheel wells on the lower fuselage can be done in the same manner. Exposed portion of lower keel at landing gear location can be painted a medium gray.

Cut the front cowl formers, C-2, C-3, and C-4 from 1/8 sheet balsa, and C-1 from 1/16. Stack and align formers carefully, then cement together. After drying, tack glue the stack of formers to front of finished fuselage. Carve and sand exterior carefully to match shape of fuselage. After final sanding, remove from the fuselage and carve out interior with a small power tool. Sand interior smooth, and use colored dope or enamel to paint inside a matt black or dark gray. Paint forward surface of bulkhead F-1 the same color. Paint exterior of cowl front blue on top and off-white on bottom to match the colored tissue used on fuselage, and cement permanently to front of fuselage.

The nose block is built up on either side of a 1/32 inch thick circle of plywood. Cylinders can be simulated by pieces of drawings or photos glued in proper locations on front of 1/32 ply circle.

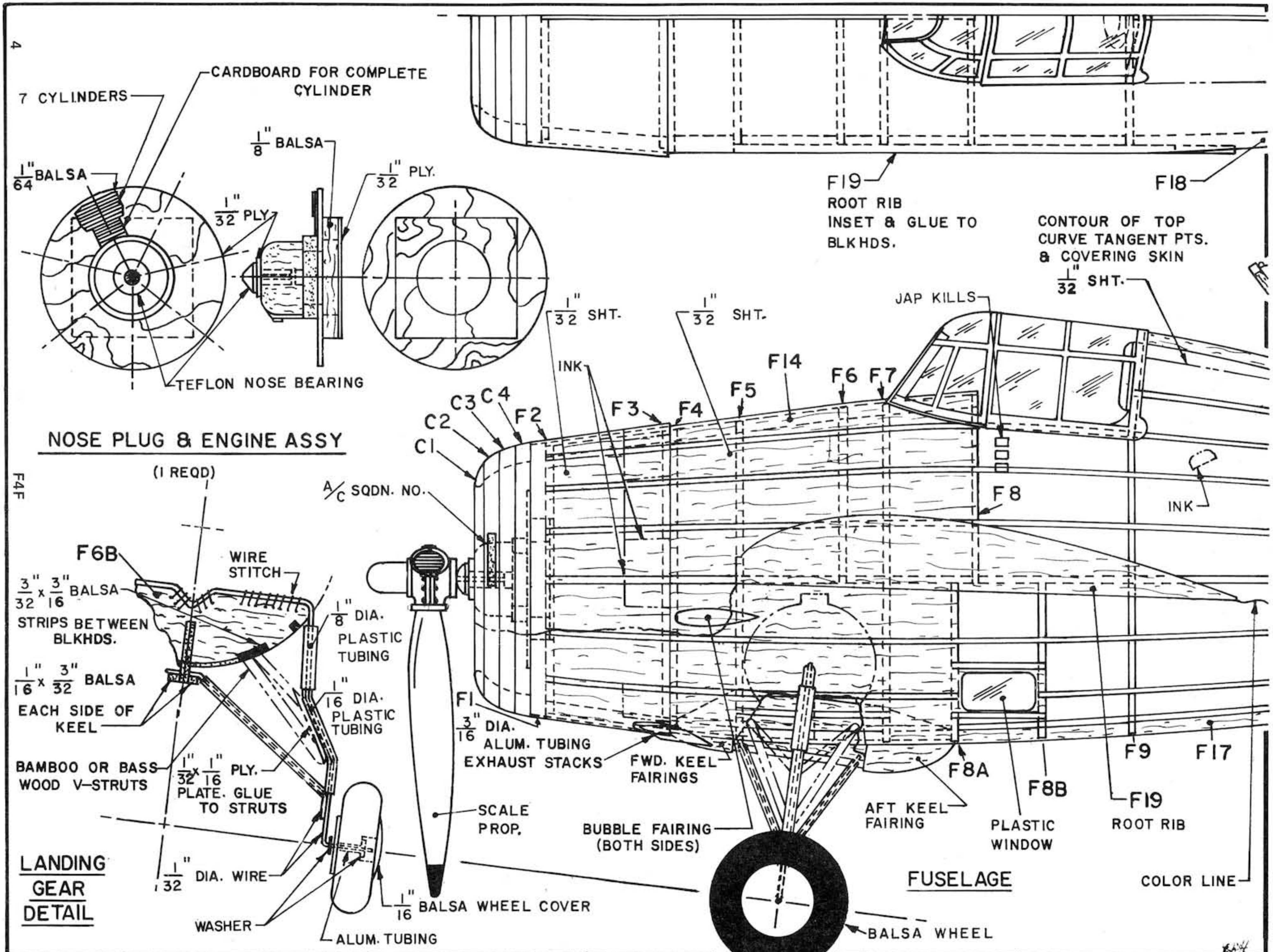
The cockpit canopy is molded from a small sheet of clear plastic that is heated and stretched over a carved form block. The actual canopy frame is simulated by applying strips of Japanese tissue using clear dope as an adhesive. If desired, the strips can be painted to match the color of the top fuselage.

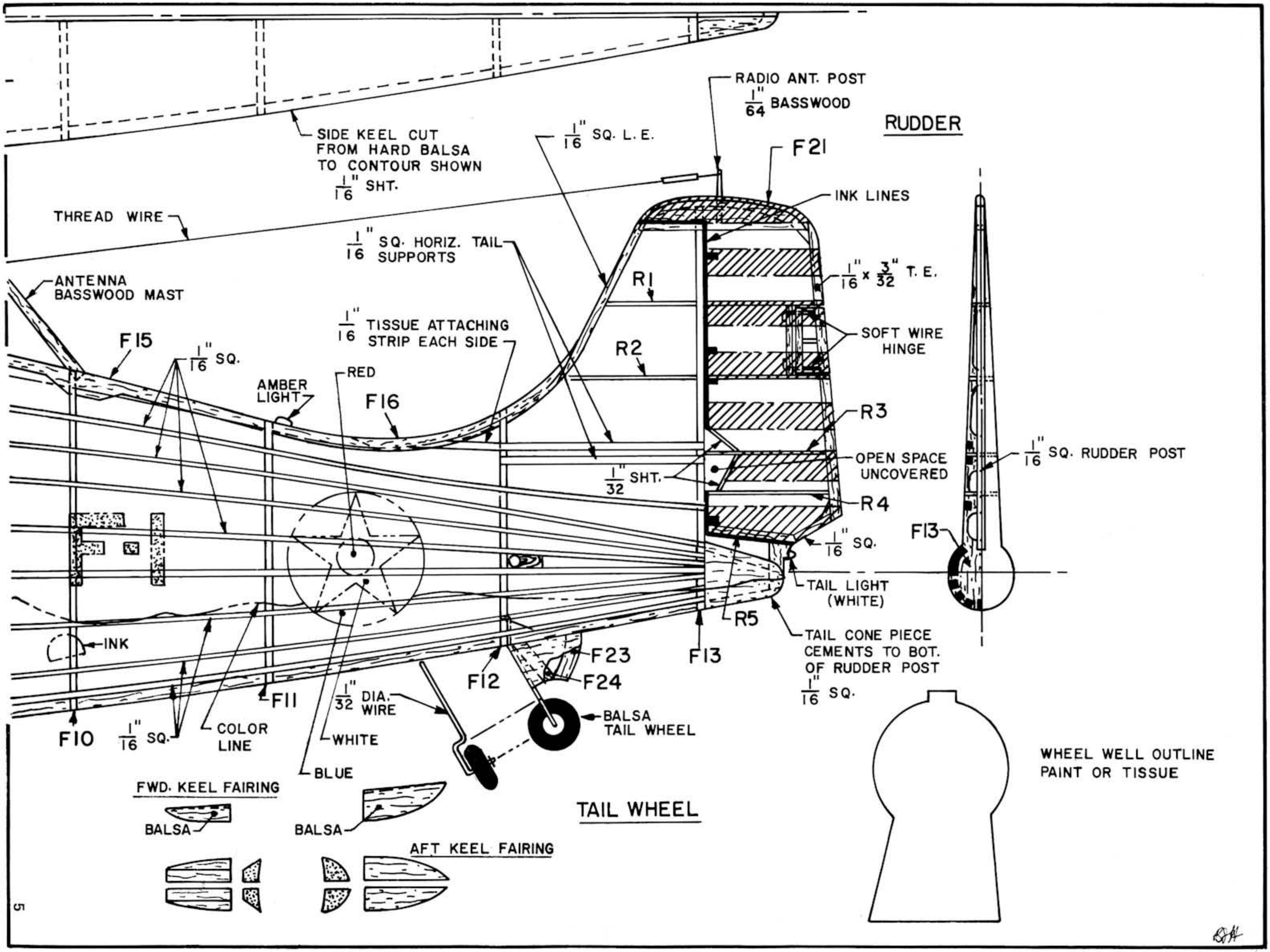
## MOTOR AND PROPELLER

A 6 or 7 inch plastic or carved balsa propeller can be used. These, of course, are of the standard two-bladed type. Also, a laminated sheet balsa prop could be constructed with the blades formed, when wet, over a curved surface such as a glass jar or a tin can. Various rubber motor combinations can be tried, with anything from a single loop of 1/8 flat rubber 13 or 14 inches long to, perhaps, two loops of 3/16 inch flat rubber of about the same length. Don't use too much power, but do try different reasonable combinations with different propellers.

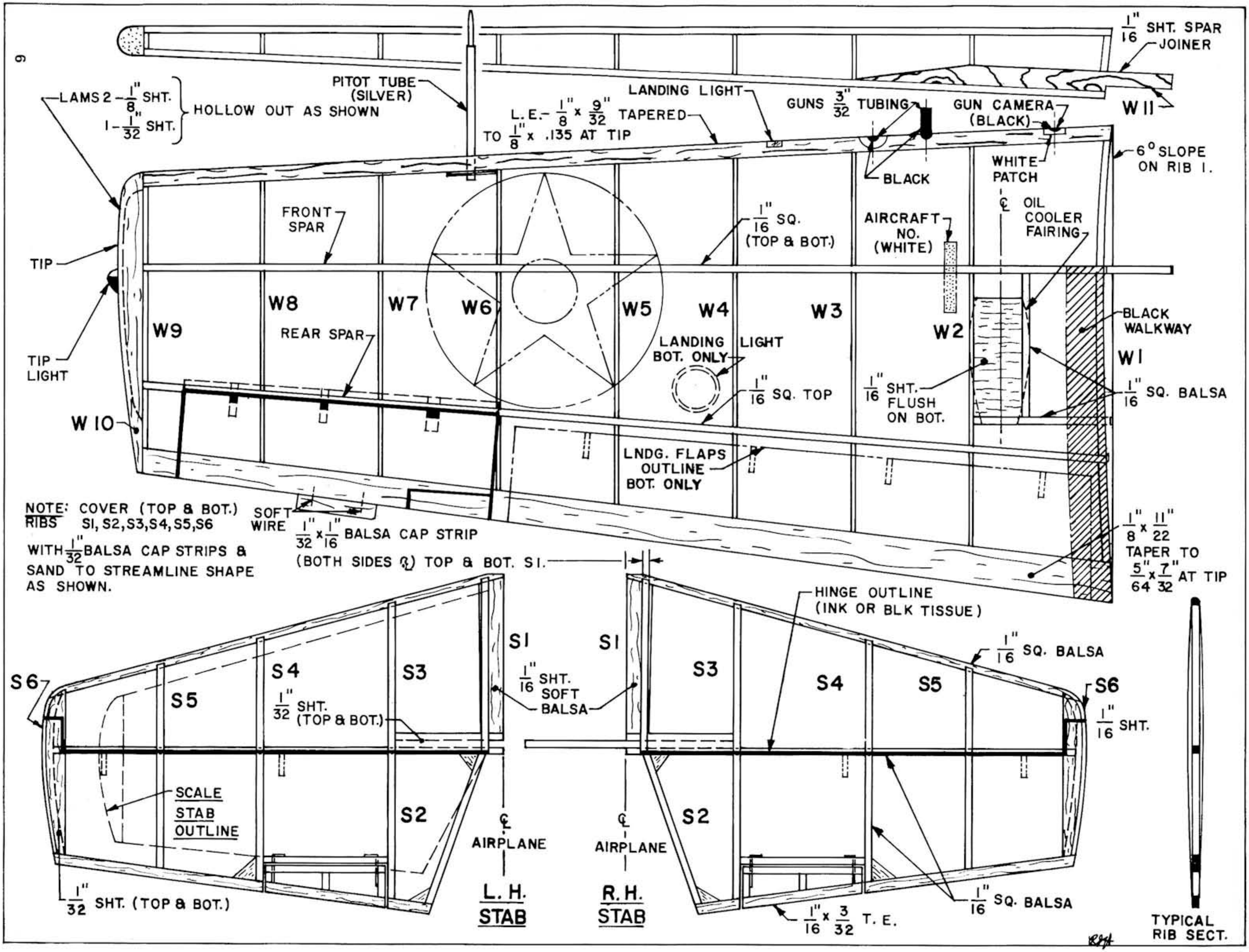
## FLYING

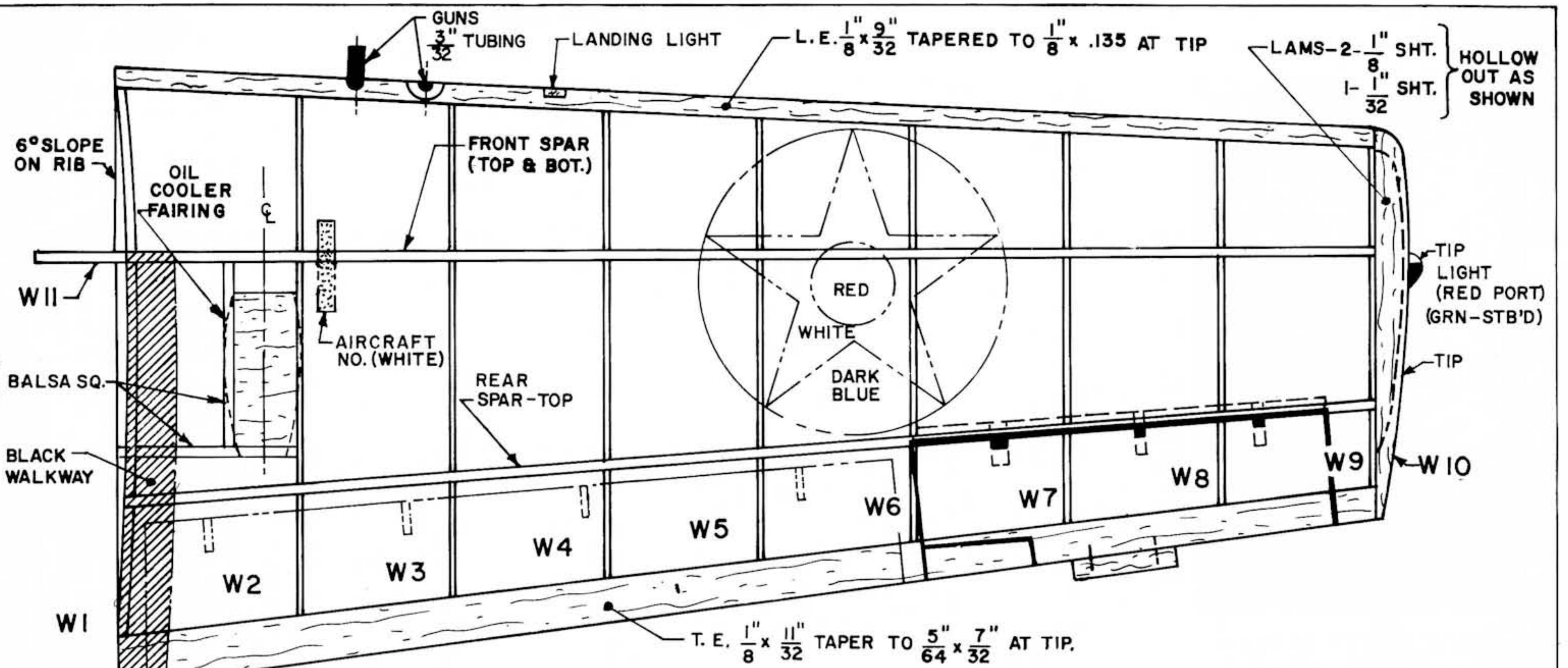
With the rubber motor installed, the model should balance at approximately the front spar of the main wing. Set rudder trim tab to give a slight left turn in glide. With all the drag of the landing gear struts, and the model being a midwing design, very little to no downthrust may be needed to control powered flight. However, a slight amount of left thrust may be set in, if the right wing aileron tab is set to keep the left wing up in turns. Begin with low power (100 turns maximum) and increase the number of turns as trim adjustments give more and more stable flights. Good luck. ●


4
F4F
NOSE PLUG & ENGINE ASSY
(1 REQD)
7 CYLINDERS
CARDBOARD FOR COMPLETE CYLINDER
1/64" BALSA
1/8" BALSA
1/32" PLY.
1/32" PLY
TEFLON NOSE BEARING
F19
ROOT RIB
INSET & GLUE TO BLKHDS.
F18
CONTOUR OF TOP CURVE TANGENT PTS. & COVERING SKIN
1/32" SHT.
JAP KILLS
1/32" SHT.
1/32" SHT.
INK
F14
F6 F7
F5
F3
F4
C1
C2
C3
C4
F2
A/C SQDN. NO.
F8
INK
F6B
3/32" x 3/16" BALSA
STRIPS BETWEEN BLKHDS.
WIRE STITCH
1/8" DIA. PLASTIC TUBING
1/16" x 3/32" BALSA
EACH SIDE OF KEEL
1/16" DIA. PLASTIC TUBING
F1
3/16" DIA. ALUM. TUBING
EXHAUST STACKS
FWD. KEEL FAIRINGS
F8A
F8B
F9
F17
F19
ROOT RIB
BAMBOO OR BASS WOOD V-STRUTS
1/32" x 1/16" PLY. PLATE. GLUE TO STRUTS
SCALE PROP.
BUBBLE FAIRING (BOTH SIDES)
AFT KEEL FAIRING
PLASTIC WINDOW
LANDING GEAR DETAIL
1/32" DIA. WIRE
WASHER
ALUM. TUBING
1/16" BALSA WHEEL COVER
BALSA WHEEL
FUSELAGE
COLOR LINE

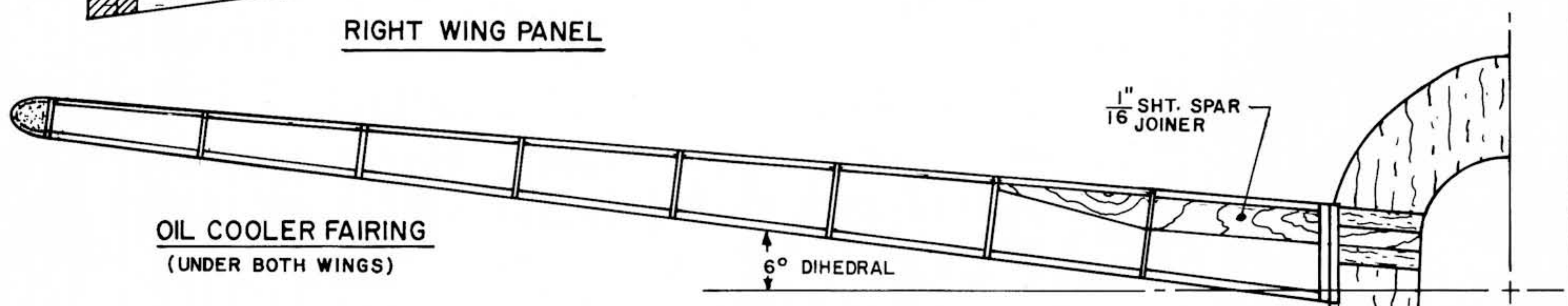


RADIO ANT. POST 1/64" BASSWOOD
RUDDER
1/16" SQ. L.E.
F21
SIDE KEEL CUT FROM HARD BALSA TO CONTOUR SHOWN 1/16" SHT.
INK LINES
THREAD WIRE
1/16" SQ. HORIZ. TAIL SUPPORTS
1/16" x 3/32" T.E.
ANTENNA BASSWOOD MAST
R1
1/16" TISSUE ATTACHING STRIP EACH SIDE
SOFT WIRE HINGE
F15
1/16" SQ.
R2
RED
AMBER LIGHT
F16
R3
OPEN SPACE UNCOVERED
1/16" SQ. RUDDER POST
1/32" SHT.
R4
F13
1/16" SQ.
TAIL LIGHT (WHITE)
R5
INK
TAIL CONE PIECE CEMENTS TO BOT. OF RUDDER POST 1/16" SQ.
F23
F13
F12
F24
F11
1/32" DIA. WIRE
BALSA TAIL WHEEL
F10
1/16" SQ.
COLOR LINE
WHITE
BLUE
WHEEL WELL OUTLINE PAINT OR TISSUE
FWD. KEEL FAIRING
BALSA
BALSA
TAIL WHEEL
AFT KEEL FAIRING


9
1/16" SHT. SPAR JOINER
W11
PITOT TUBE (SILVER)
LANDING LIGHT
GUNS 3/32" TUBING
GUN CAMERA (BLACK)
LAMS 2 - 1/8" SHT. 1 - 1/32" SHT. HOLLOW OUT AS SHOWN
L.E. - 1/8" x 9/32" TAPERED TO 1/8" x .135 AT TIP
BLACK
WHITE PATCH
6° SLOPE ON RIB 1.
FRONT SPAR
1/16" SQ. (TOP & BOT.)
AIRCRAFT NO. (WHITE)
℄
OIL COOLER FAIRING
TIP
TIP LIGHT
W9
W8
W7
W6
W5
W4
W3
W2
W1
BLACK WALKWAY
REAR SPAR
LANDING LIGHT BOT. ONLY
1/16" SQ. TOP
1/16" SHT. FLUSH ON BOT.
1/16" SQ. BALSA
W 10
LNDG. FLAPS OUTLINE BOT. ONLY
NOTE: COVER (TOP & BOT.) RIBS S1, S2, S3, S4, S5, S6 WITH 1/32" BALSA CAP STRIPS & SAND TO STREAMLINE SHAPE AS SHOWN.
SOFT WIRE
1/32" x 1/16" BALSA CAP STRIP (BOTH SIDES ℄) TOP & BOT. S1.
1/8" x 11/22" TAPER TO 5/64" x 7/32" AT TIP
HINGE OUTLINE (INK OR BLK TISSUE)
S1
S2
S3
S4
S5
S6
1/16" SHT. SOFT BALSA
1/32" SHT. (TOP & BOT.)
1/16" SQ. BALSA
1/16" SHT.
SCALE STAB OUTLINE
℄ AIRPLANE
1/32" SHT. (TOP & BOT.)
L. H. STAB
R. H. STAB
1/16" x 3/32" T. E.
TYPICAL RIB SECT.



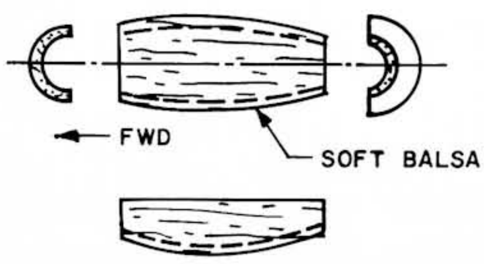

RIGHT WING PANEL



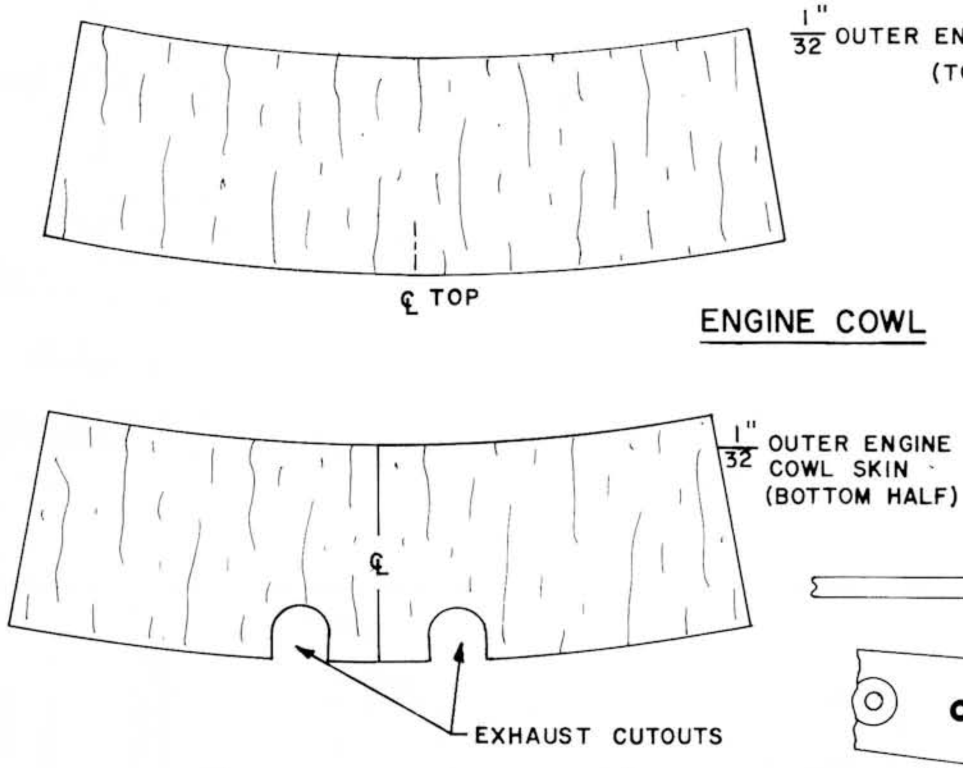

FRONT VIEW

OIL COOLER FAIRING

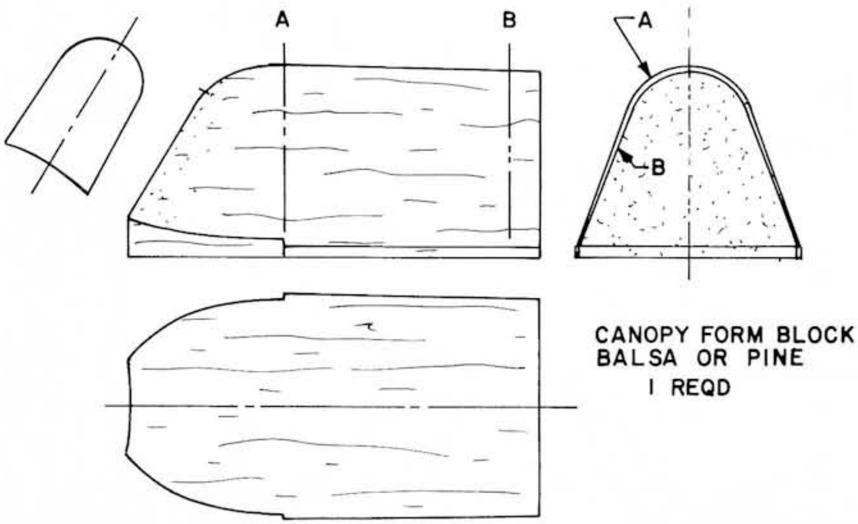
(UNDER BOTH WINGS)



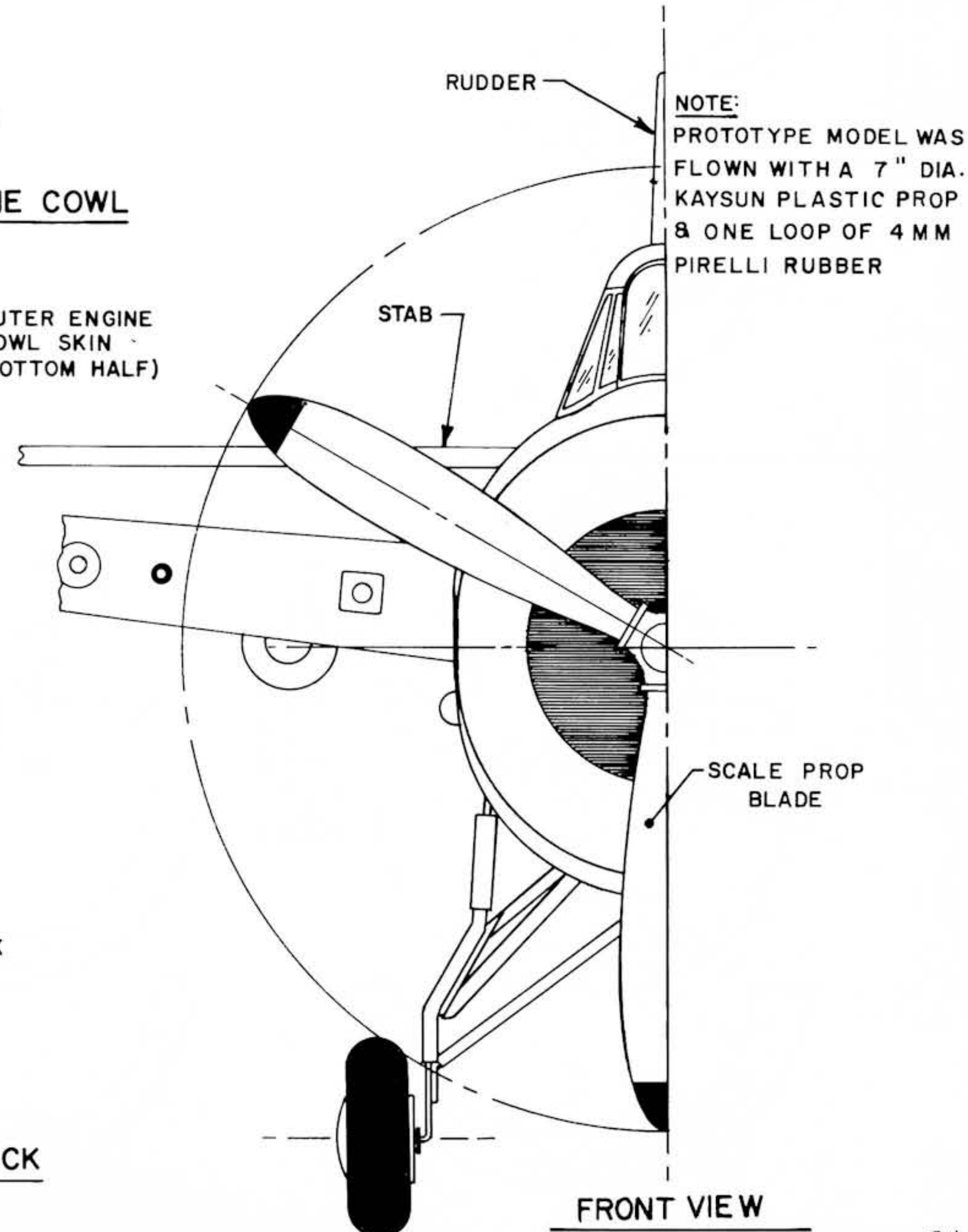

F4F




ENGINE COWL

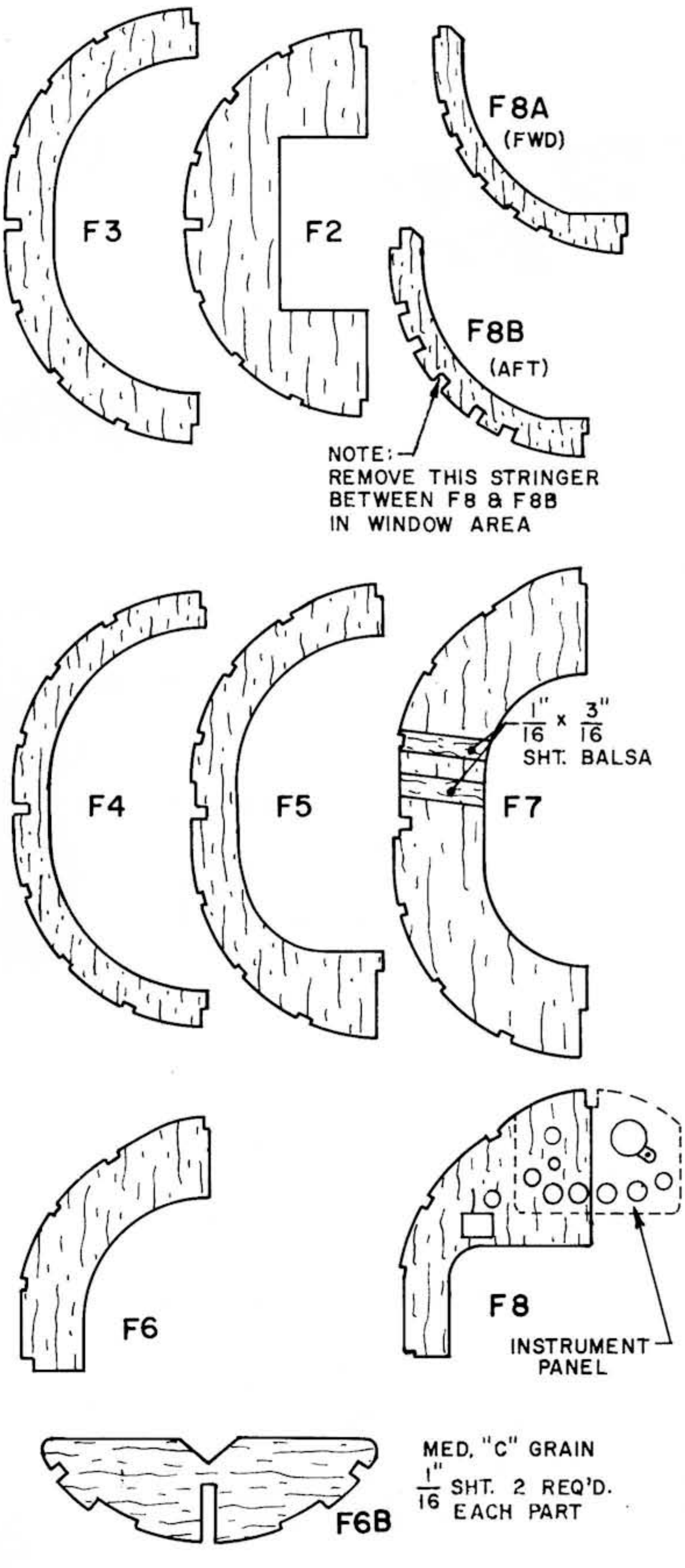


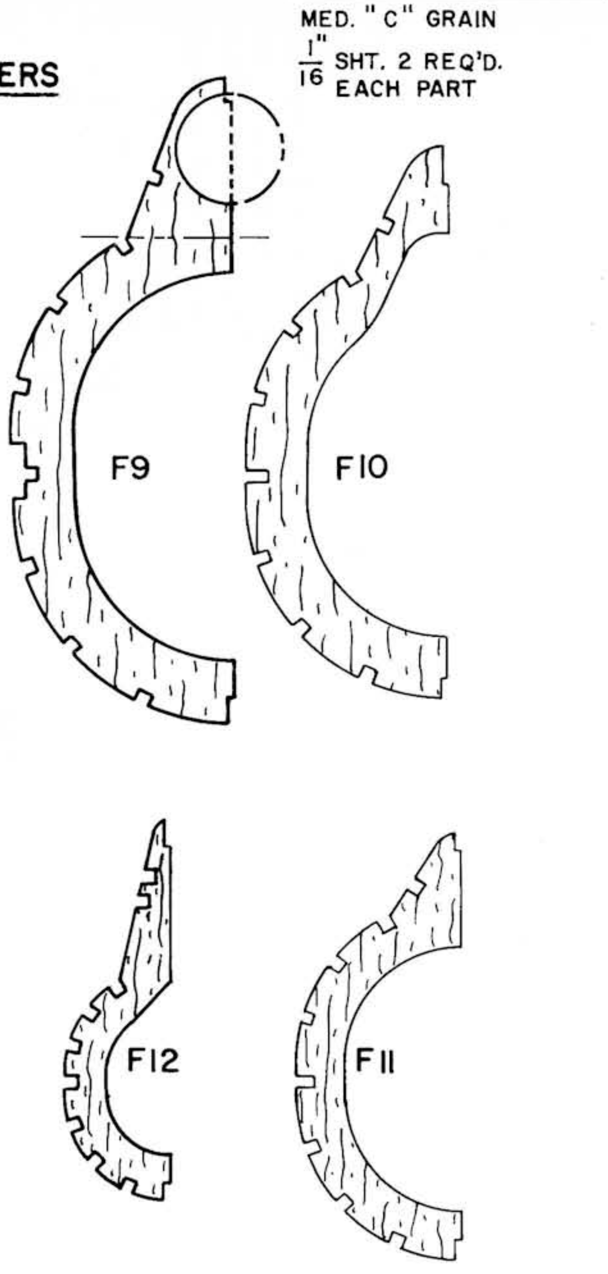

CANOPY BLOCK

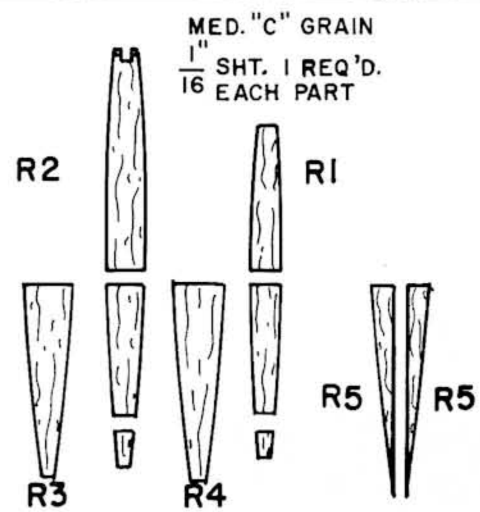



FRONT VIEW

## FUSELAGE FORMERS

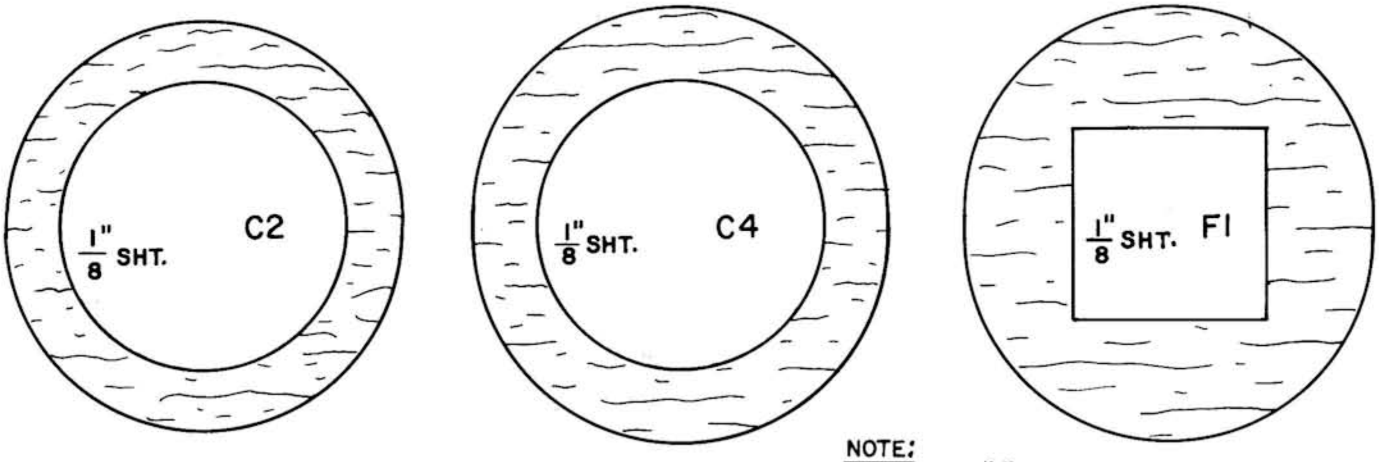


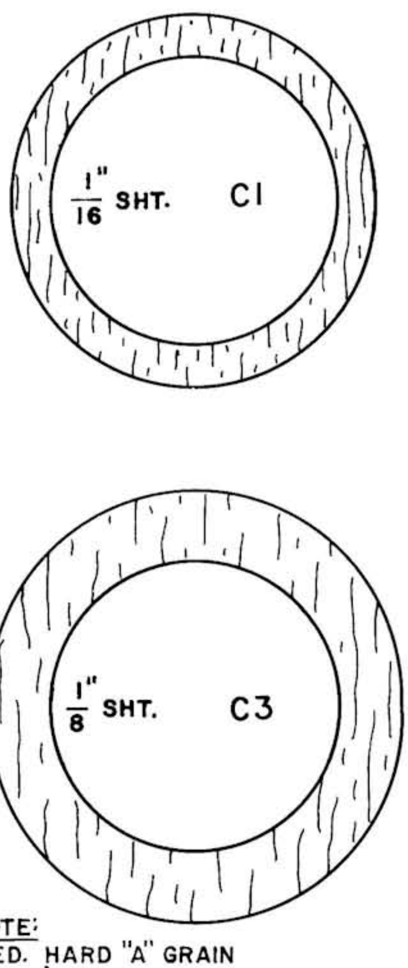




## RUDDER FORMERS

## NOSE COWL LAMS.

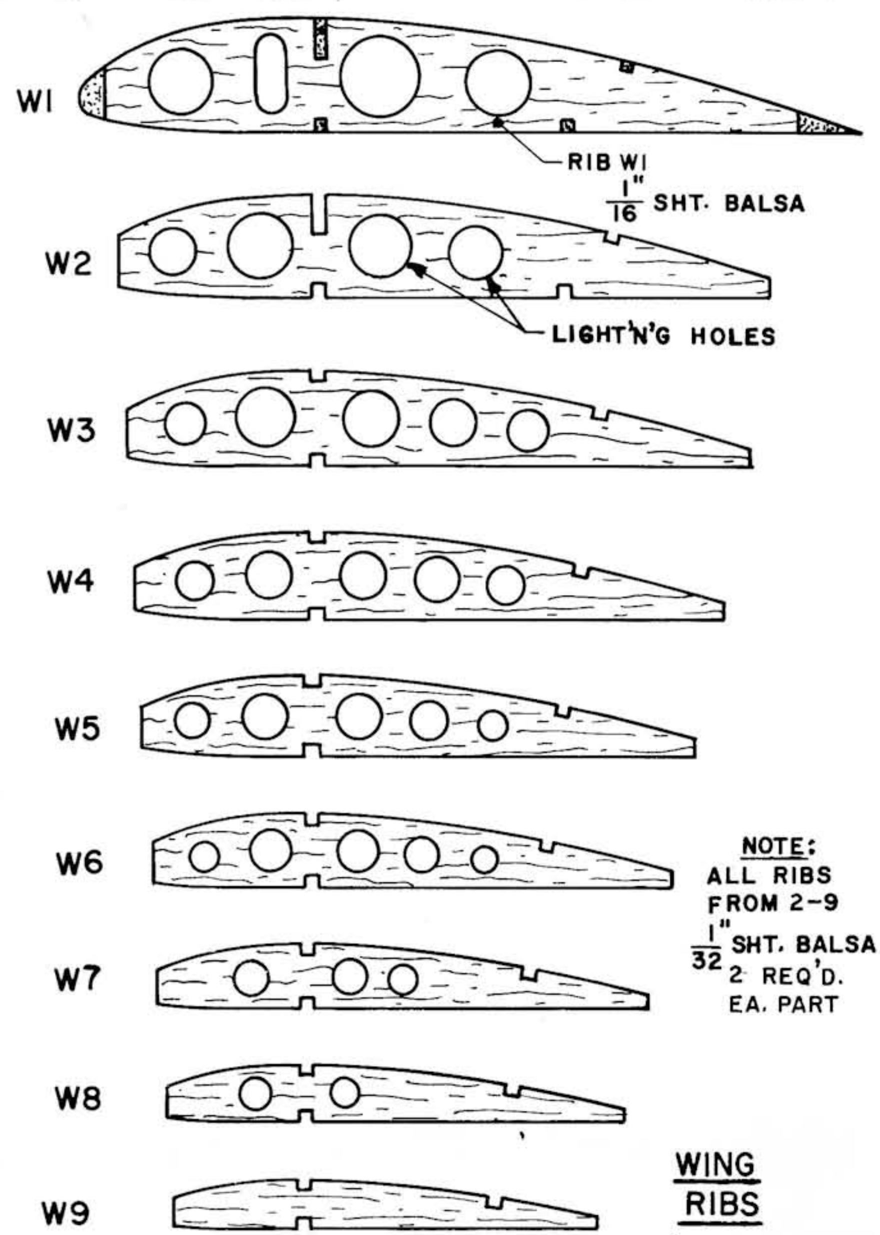



NOTE:
MED. HARD "A" GRAIN
1 REQ'D. EA. PART



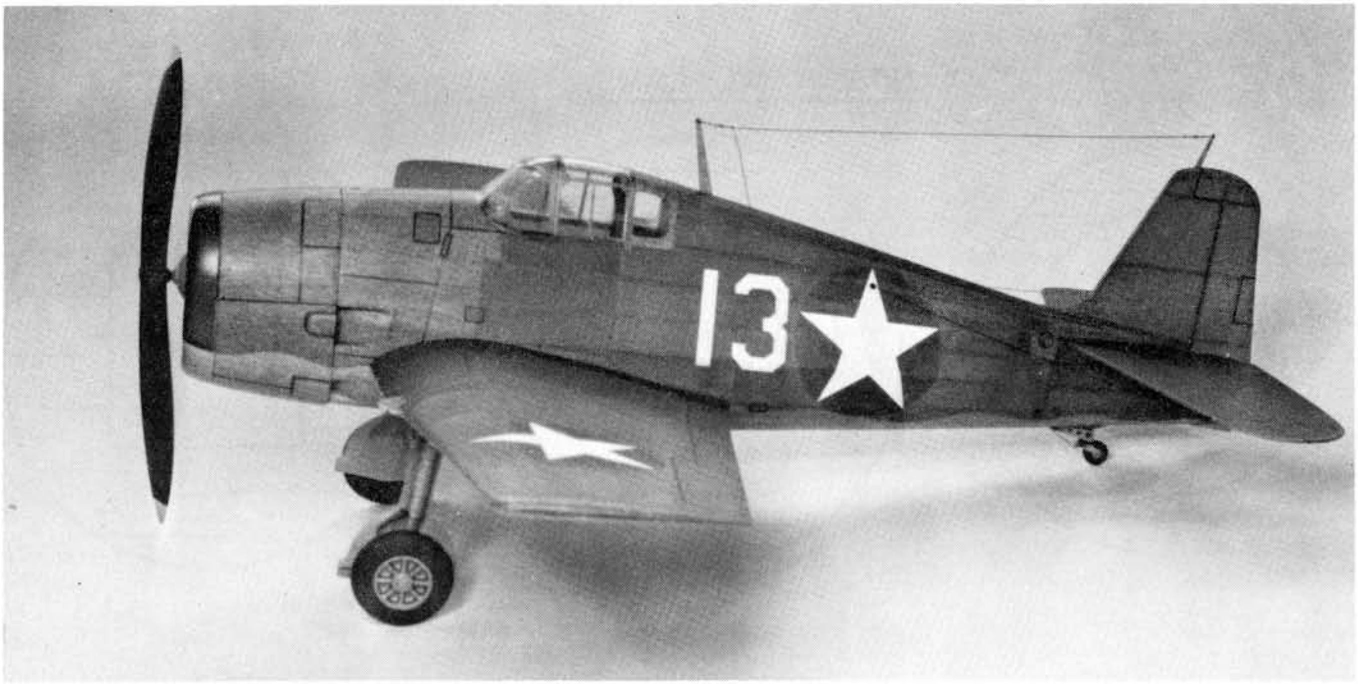

NOTE:
MED. HARD "A" GRAIN
1 REQ'D. EA. PART

## NOSE COWL LAMS.




NOTE:
ALL RIBS
FROM 2-9
1/32" SHT. BALSA
2 REQ'D.
EA. PART

## WING RIBS




**The Hellcat is one of those rare exceptions where downthrust is scale! A 6 inch Kaysun Plastic prop was used for flying.**

# GRUMMAN F6F HELLCAT

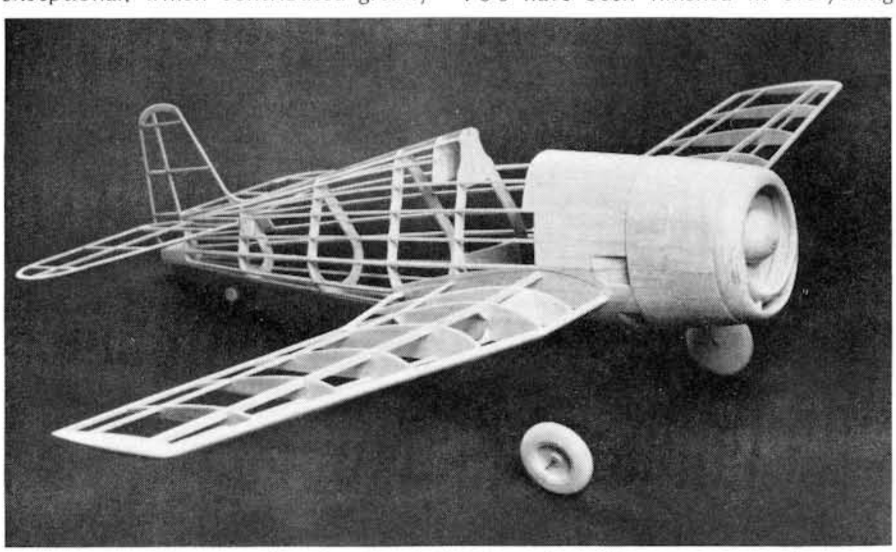
By BILL HANNAN

● The Grumman "Hellcat" was one of the most effective aircraft of World War II, and its design parameters were largely dictated by actual combat veterans, as an answer to the "Zero Menace." A descendant of the F4F "Wildcat," the F6F was superior in virtually every respect. Powered by a Pratt and Whitney R-2800 Double Wasp, rated at 2,000 horsepower, the "Hellcat" had a top speed of about 375 miles per hour. The engine was mounted at a noticeable down-thrust angle, which, coupled with the minimum wing incidence, resulted in a distinctive tail-low flight attitude. The structural strength of the machine was exceptional, which contributed greatly to the confidence of its pilots.

There were two basic types of "Hellcat" which were produced in quantity, the F6F-3 and the F6F-5. External differences were minor, and it would be possible to adapt our model to either type. A large quantity of information has been published concerning these machines (see reference list at end of article), and it is suggested that one or more of these publications be acquired before starting the model. In this way, a builder can select coloring and markings of his choice, and incorporate the small external differences found in individual aircraft. It will be noted that F6's have been finished in everything from "Plain Jane" through elaborate "shark-mouth" paint schemes. In fact, the author had difficulty reaching a decision from the many available alternatives.

Our prototype model features 1942 camouflage and markings, based upon an early production F6F-3 used during the Hellcat's aircraft carrier trials. A photograph of this machine appears in the Caler Illustrated Series book "U.S. Navy Markings, W.W. II - Pacific Theater," by Thomas E. Doll. We would like to extend special thanks to Mr. Doll, who also provided us with additional research material relating to this aircraft.

During preparation for the model, a great deal of conflicting information was encountered, particularly in regard to 3-view drawings. Wherever discrepancies were noticed, photographs were used in preference to drawings in reaching conclusions. And, while certain changes were made for practical construction and flight stability reasons, an effort was made to retain the character of the full size Hellcat.



**The nose of the Hellcat was filled in with soft 1/16 balsa sheet. This improves strength where needed and helps obtain proper balance when the model is flown. Note light tail structure.**

SELECTION OF MATERIALS

Our prototype model was designed primarily for outdoor flying under average weather conditions, and materials were selected accordingly. Light but firm wood was used, with certain exceptions, such as the wing spars, leading and trailing edges, rear motor peg mounts and front three cowling rings, which were made from hard stock. Particular care was taken to keep the rear of the fuselage and tail surfaces light, to minimize the need for nose ballast.

CONSTRUCTION

The fuselage is constructed in the traditional "half shell" manner. Each basic keel is made from two 1/16 square balsa strips, which are laminated with white or Titebond glue, and pinned to the workboard directly over the plan while drying. Note that the diagonal strip between F-6 and F-7 in the cockpit area is only temporary, and will be removed later. All bulkheads are cut from 1/16 sheet balsa, and two of each half are required. Cement one set of bulkhead halves in respective locations along the upper and lower keels. Use a small triangle to check the vertical alignment of each. Allow to dry thoroughly.

Meanwhile, laminate two side keels, which can be pinned to shape directly over the top view drawing, one at a time. When dry, they may be removed from the board, and one of them installed in the fuselage half shell which is pinned down. When the half shell is dry, remove the assembly from the board and continue construction by carefully gluing the second set of bulkhead halves in position and adding the second side keel. The engine cowling is constructed separately in exactly the same manner as the fuselage.

Install the partial bulkheads F-6 and F-8. Note that the paper instrument panel should be added to F-6, but not until a bit later in the program. Begin installing the fuselage stringers, first giving each a trial installation. Occasionally, owing to drawing inaccuracies, cutting slippages, and "Murphy's Law," a stringer will be found to have a slight "bobble" in it and will not smoothly follow the contour between bulkheads. In this event, it is best to enlarge the offending bulkhead slot as needed to shift the stringer into alignment. Afterwards the oversize notch may be filled in with scrap wood, if desired. Taking the time to make these small corrections will result in a better final product. As each stringer is installed, its opposite number should be next in place. The object, of course, is to avoid pulling the fuselage out of line, which may occur if more than one stringer is added to one side at a time. Once the stringers are in place, the short diagonal keel piece between F-6 and F-7 may be removed, and the instrument panel drawing glued on.

Note that additional stringers may be added between indicated stringers if desired, to obtain smoother contours. The problem is, though, that the weight can increase rather alarmingly if one gets carried away. A flying model of necessity must be a compromise between strict accuracy and practical considerations.

Install the 3/32 sheet balsa wing

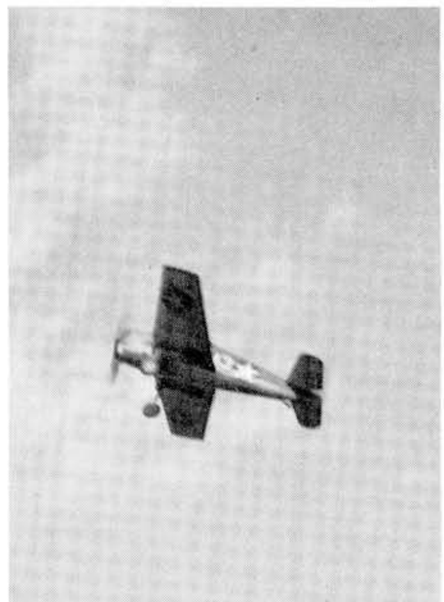
Bill's model of the Hellcat was covered with colored transparent tissue. The text explains how he got the two-tone effect of dark blue on top and light grey underneath. Lines are India ink.

saddle pieces as indicated on the side view drawing. The balsa ring laminations for the extreme nose are best sanded to shape before gluing to the cowling. A careful look at photographs will help in understanding the contours involved. The two "teeth" are carved and installed by the trial and error method. Note that the nose button is removable for winding, but should be a snug fit. The cowling and forward portion of the fuselage may either be covered with 1/32 sheet balsa or filled in between the stringers with soft 1/16 sheet. The latter method is rather tedious, but results in an exceedingly strong assembly. Again, the balsa covering or fill-in could be extended further aft for greater realism, but consider possible weight penalties carefully!

The cockpit interior may be covered with light green tissue or painted pale green to simulate the zinc chromate primer used inside the real machine. The scrap balsa headrest may be painted black.

WINGS

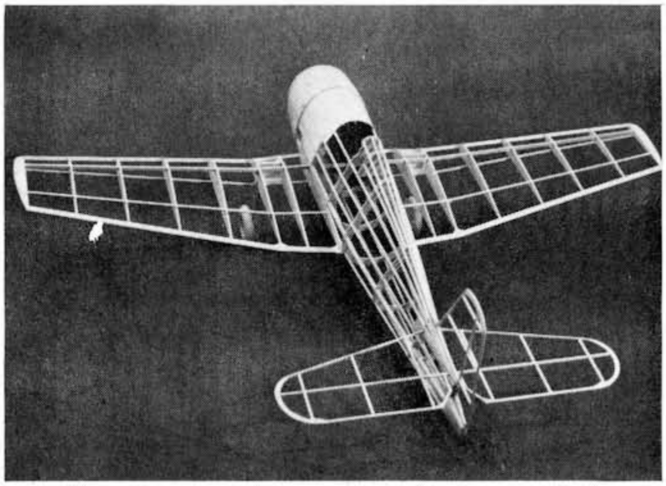
Cut two each of the wing ribs from 1/16 sheet balsa, except for the W-1s, which are 3/32 sheet. Pin the 3/16 x 1/16 trailing edge strips and the 1/16 square lower spar onto the building board directly over the plan. Install each wing rib, trimming slightly if required for a perfect fit. Next, install the hard 1/8 square leading edge. After allowing plenty of drying time, crack the leading and trailing edges plus lower spar at the W-3 rib positions, and elevate the wing tips for the correct amount of dihedral. Note that the trailing edge tips are elevated an extra 3/32 to provide wash-out, as a stability aid. Add both upper spars, and the gussets at the dihedral breaks. Shape and glue on the light balsa tips. Also install the hard balsa landing gear mounts and gussets. Sandpaper the leading and trailing edges to final contour.



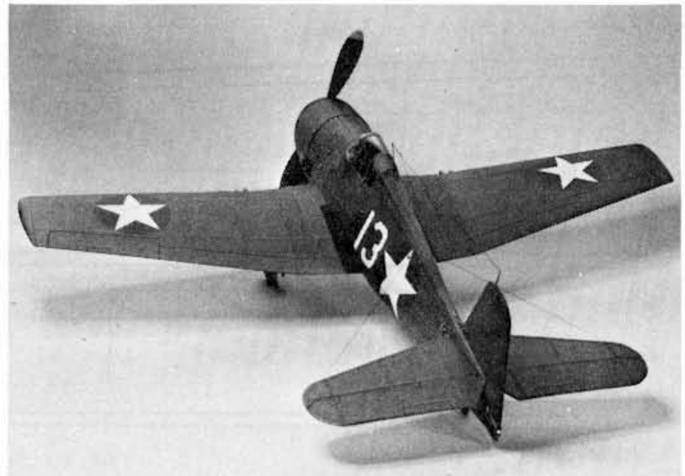
Bill's Hellcat climbs away from a hand launch.

TAILPLANES

The tail surfaces are constructed from 1/16 square balsa strips plus the 1/16 sheet balsa tip members, directly over the drawings. When dry, remove from board, and sand edges to a rounded contour.



Bulkheads are sanded away between stringers to allow covering to flow smoothly fore and aft.



It is important, if you intend to fly the model, to add washout to the tips of the wing for improved stability.

LANDING GEAR

The load absorbing members of the main landing gear are bent from .040 diameter music wire as indicated. These are glued in position and sandwiched with 1/16 hard balsa reinforcement pieces, glued firmly in place. The detailing is best added after the wings are covered with tissue, but will be described here. Build up the main struts from balsa sanded round, then split to permit installation around the landing gear leg wire. Strips of paper are wound and glued on to build up the various areas of different diameters. The landing gear leg covers and doors are thin card stock, with other details of scrap balsa, etc. Again, it is suggested that photos of the real machines be examined by those who may care to add extensive detailing. While it would be possible to construct actual wheel wells, we elected to simply simulate them with black tissue paper.

COVERING

All structure should be carefully sanded to blend the components smoothly together and eliminate surface roughness and any slight misalignments. The bulkhead areas between the fuselage stringers may be scalloped with a round sanding stick, for a smoother covering job. If you intend to duplicate the recessed areas directly behind the cowling (exhaust outlets) this operation should be performed before covering. Alternatively, these areas may be simulated with dark colored tissue.

Apply two coats of clear dope to every portion of the structure which will touch tissue paper, with the following exceptions: Only the outlines, of the wings, the dihedral joint ribs and outlines of the tailplanes are doped. After drying, lightly sand all the doped areas to remove balsa fuzz, and apply two more coats of clear.

We used colored tissue for all covering, and applied it by brushing dope thinner directly through the tissue from the top side, which softens the dope on the framework to provide adhesion. Additional clear dope can be brushed along the edges for a firm seal. In the case of stiffer "art store" type domestic tissues, extra attention may be required to ensure complete adhesion. For the fuselage, it is perhaps easiest to apply many small sections, rather than to wrap on larger portions. The tissue is also applied over the sheet balsa areas for uniform appearance. Compound areas will require tissue application in small pieces. Alternatively these areas may be painted, although it is difficult to achieve a good match with the tissue. Again, it is sometimes a matter of compromise between optimum visual effect and practical considerations.

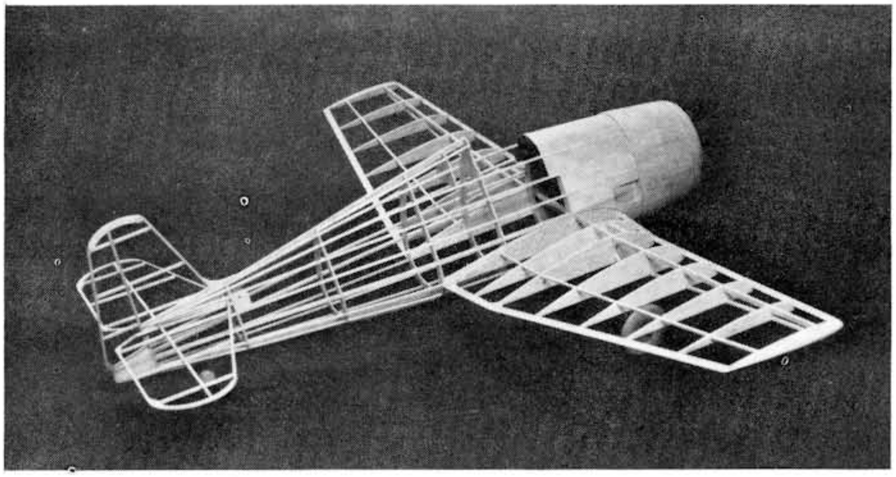
The top of each wing panel can be covered in two sections, and the bottoms similarly treated. Extra strips will be needed for the tips, however. We use alcohol rather than water to shrink our tissue, as it seems to have a milder action, less apt to cause warps. It is, however, best to pin or weight the surfaces to some sort of a jig during shrinking and subsequent doping, to retard warpage. Plasticized dopes such as Sig Litecoat are suggested. We generally settle for two thinned coats, but in moist geographical locations, more may be required.

The two-tone color scheme of our Hellcat required some extra steps. The wavy separation between the two fuselage colors may be achieved in either of two ways (other than painting). If you are using fairly opaque tissue, you may be able to simply apply the wavy blue section of tissue directly over the grey tissue. If, on the other hand, your tissue is quite transparent, a muddy effect may occur if you overlap large areas. The approach then is as follows: Two layers of grey and two layers of blue tissue are taped onto a sheet of cardboard. Next, a tracing of the wavy separation line is made on this paper, such as draftsman's vellum. This is taped over the previously mentioned tissue. Using a very sharp pointed modeling knife, a cut is made clear through the tracing paper and 4 layers of tissue along the wavy color line. Next, a thick coat of clear dope is carefully applied along each wavy edge of each sheet of tissue, in a strip about 1/16" wide. A sheet of transparent plastic wrap is then taped down to the working area. Align the wavy edge of a blue tissue sheet with the corresponding edge of a grey sheet with a slight overlap, say a little over 1/32 inch. Now flow some thinner from a pointed brush THROUGH the two layers of tissue along the previously clear doped area, causing the two sheets to adhere to each other. Now the tissue may be cut into the required strips for application to the model.

All of the various details and markings are applied before assembling the model, for ease of handling. These items take extra time, but make the difference between a so-so model and an outstanding one. The one deviation from tissue for our markings concerns the white areas of the numbers and stars. Tissue is too transparent for this purpose, as the underlying color shows through. While it would be possible to inlay white tissue in the same manner as the wavy line was created, it is much easier to simply employ opaque white paper. The thin lines such as aileron outlines, cowl flaps, etc., may be made from black tissue, ruled on with india ink, or applied with chart tape.

CANOPY

The original model canopy was formed over a carved balsa block with the aid of a Mattel Vac-U-Form toy. The mold should be primered and sandpapered to minimize the grain of the wood. The various "window frames" may be achieved on the mold with strips of tape, or if desired, applied to the finished canopy in any of several possible manners. Chart tape can be used for the frame outlines, as can colored tissue paper. Alternatively, the canopy can be suitably masked and the line sprayed on. The poorest approach, in our opinion, is to paint the lines on



**Note high position of the rear rubber peg. This helps maintain the downthrust which is so important for smooth, steady flights.**

**The Hellcat glides in to land after another successful flight. Ship flies quite well.**

with a brush, which is almost bound to produce unsatisfactory results, not to mention frustration!

A duplicate vacuum-formed canopy may be ordered from Sig Mfg. Co., Montezuma, Iowa.

ASSEMBLY

Trial fit the wing panels to be certain of alignment, and if necessary, trim for a perfect fit. When both panels fit properly, glue them in place. Be generous with the adhesive, since the wings must absorb not only flight loads, but the landing-gear shocks as well. A 1/8 x 1/16 hard balsa strip glued across the intersection of the main wing spars will add strength to the assembly.

Cut the small section from the rear fuselage vertical keel member to allow the stabilizer to be installed. Check the alignment of the stab carefully, and glue in position. Cut a small piece of 1/16 sheet balsa to serve as a filler behind the stabilizer, cover the exposed edges with appropriate color tissue, and glue in place. Check the fit of the vertical tail, and if satisfactory glue into position.

Add the various remaining details such as antenna masts, landing gear doors, tail wheel details, etc. It is suggested that the antenna wires be left off until test flying has been completed, since they tend to interfere with handling of the model. Now is the time to carefully examine your reference photographs for differences in markings and details. For example, the F6F-5 versions featured slightly simplified canopy struts, and many of them did not have the rearmost side windows. The fairing over the side exhaust stacks was also eliminated (even on some F6F-3s) and other changes were made in the cowling, inspection panels, etc. The fairings around the wing guns were eliminated on later F6F-3s and all of the F6F-5s.

A simple, yet effective engine can be simulated with Williams Brothers 3/4 inch scale dummy cylinders. These can be cut in half, shortened as required, and fastened to the inside cowl face with contact cement.

PROPELLER

Our test model was flown with a 6 inch diameter Kaysun Plastic prop, which worked quite well. Our drawing includes a scale 3-blade type which could be fabricated for display purposes if desired.

POWER

We used a single loop of 4mm Pirelli rubber, or two loops of 1/8 inch brown rubber. Heavier models might require additional power, while a very light model might need less. Experimentation seems the only answer to this question.

FLYING

Check model carefully for warped surfaces. If any are detected, the offending part may be held over a steaming teakettle, and the warped part twisted the opposite way. Upon cooling the warp should be absent. Check again later though, as some warps seem to return with changes of temperature or humidity.

Although we are seldom able to find both, we must suggest the traditional tall grass field and calm day for test flying. Assuming the model balances close to the point shown on the side view drawing, try a few gentle hand glides. Remember to release the model smoothly and not too fast, in a slight nose down attitude. The addition of ballast to the nose (most likely) or tail should correct any stalling or diving tendencies. If the model persists in falling off on one wing, add a small lump of clay ballast to the opposite wing. When the glide appears satisfactory, try a few turns in the rubber motor. The flight path should be smooth, with no strong tendencies in any direction. If stalling under power occurs, add a downthrust shim at the top of the thrust button. If the flight circle is too tight, or there is sufficient turn, correct with a side thrust adjustment shim. More turns are added to the rubber motor, and any needed readjustments performed. Sometimes a little bit of tail surface "tweaking" can be helpful, but should not be overdone. When all is in order, stretch wind with a mechanical winder for best performance.

This model would also be a "natural" for Brown Jr. $CO_2$ engine power.

SCALE REFERENCES:


"GRUMMAN F6F 'HELLCAT,' No. 3 WARPLANE RESEARCH," Air Age Technical Library, 1944

"U.S. NAVY MARKINGS, W.W. II - PACIFIC THEATER," by Thomas E. Doll (Caler Illustrated) 1967

"FAMOUS FIGHTERS of the Second World War," Second Series, by William Green, 1962

GRUMMAN F6F-3/5 HELLCAT IN USN-USMC-FAA-AERONAVALE & URUGUAYAN SERVICE," Aircam Aviation Series No. 19, 1971

"MARKINGS OF THE ACES, Part 2, U.S. Navy," by Richard Hill. Kookaburra Technical publications, 1969

"CARRIER FIGHTERS," by J.V. Mizrahi. Sentry Book, Volume II, 1969

"GUIDE TO MODEL AIRCRAFT," edited by David C. Cooke. Robert M. McBride & Co., 1945

"INDUSTRIAL AVIATION," Grumman "Hellcat," June, 1945

"FLYING," Grumman "Hellcat" Fighter, November, 1943

"GRUMMAN 'HELLCAT,' F6F," Modern Hobbycraft Products Aircraft Plans, 1943

"RAF FLYING REVIEW," Grumman Hellcat, Vol. XVII, No. 3

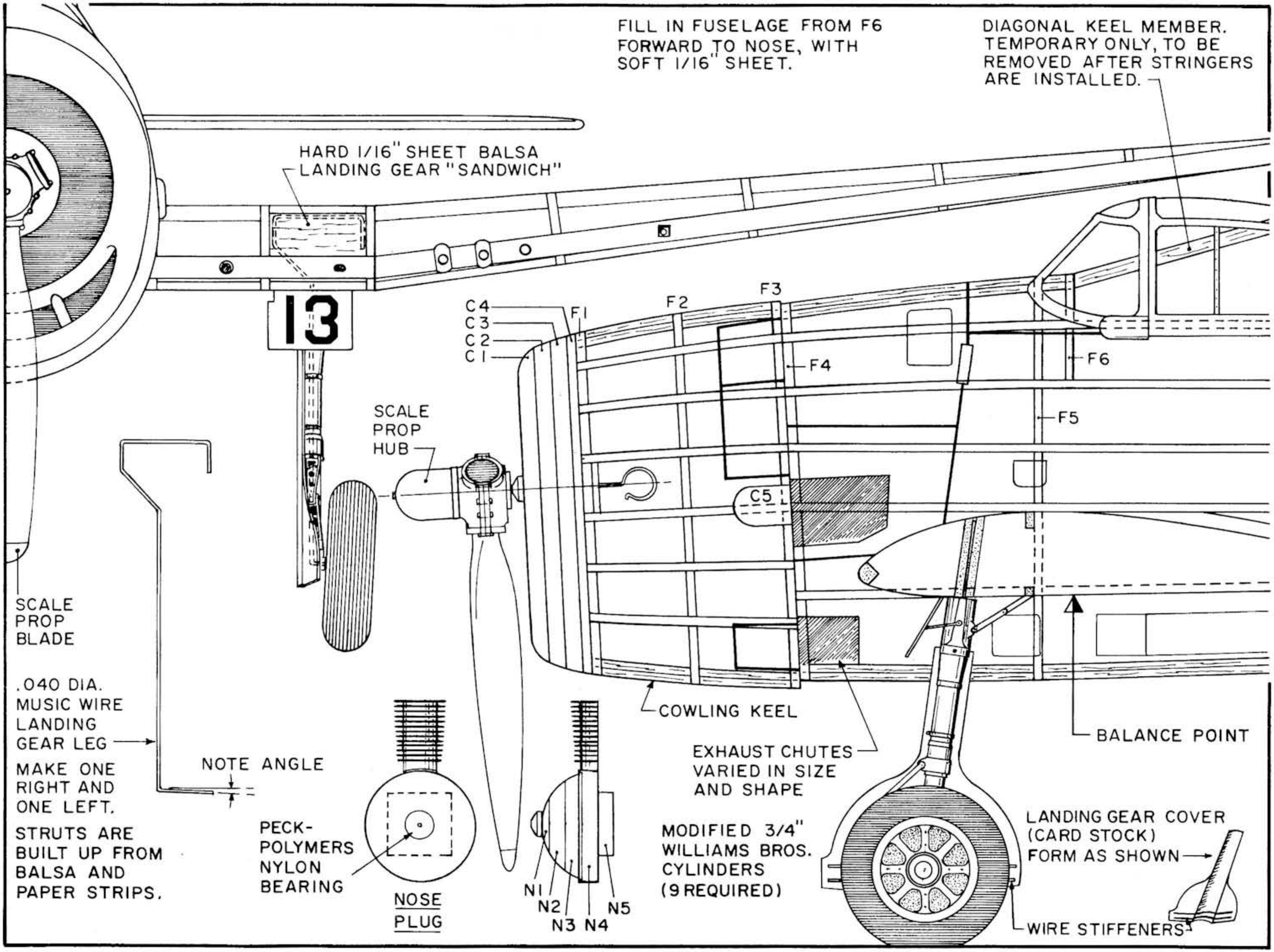
"GRUMMAN F6F HELLCAT (Famous Airplanes of the World)," Japan, 1972

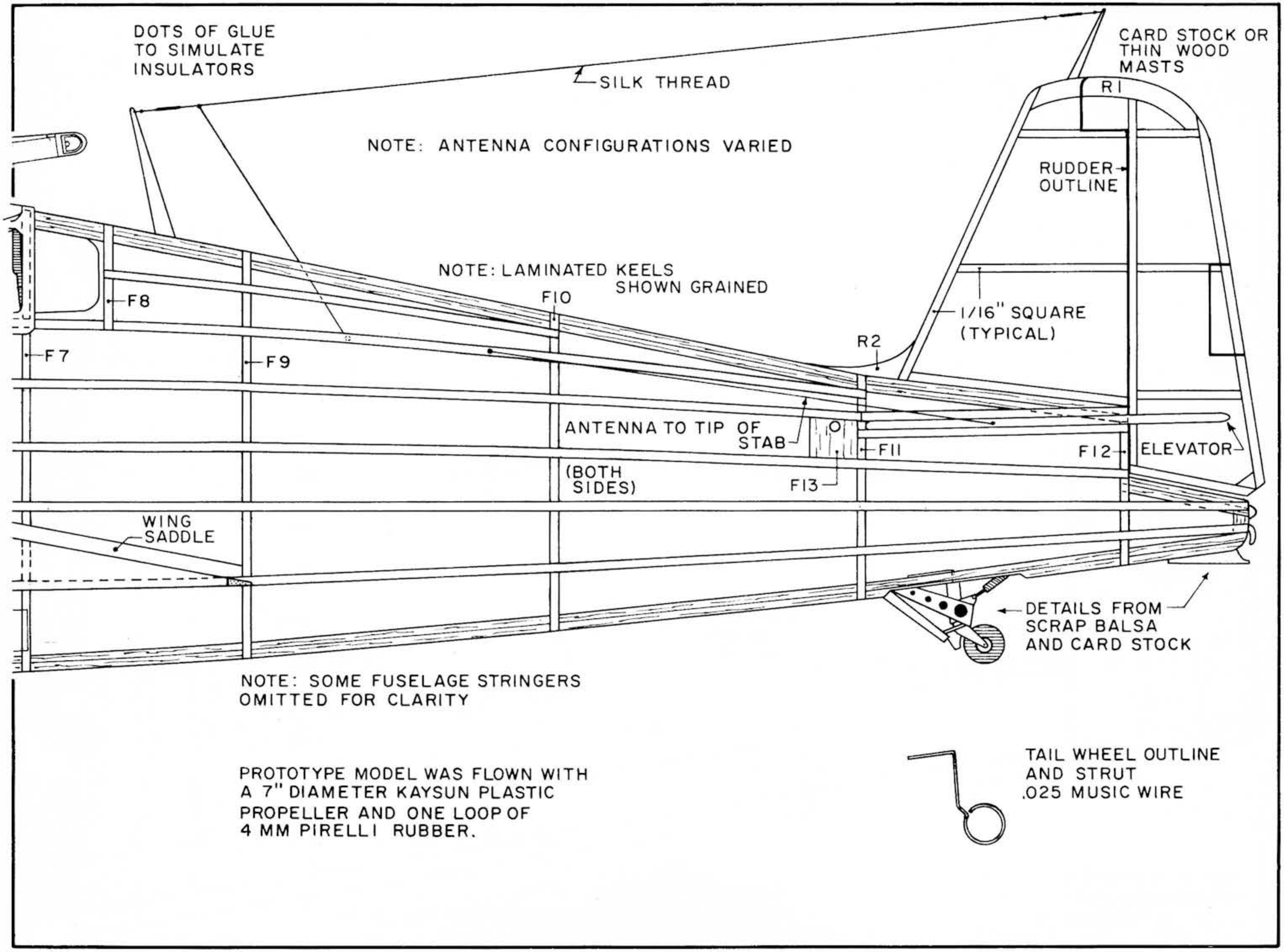
"MODEL AIRPLANE NEWS," Hellcat scale drawings by Willis L. Nye.

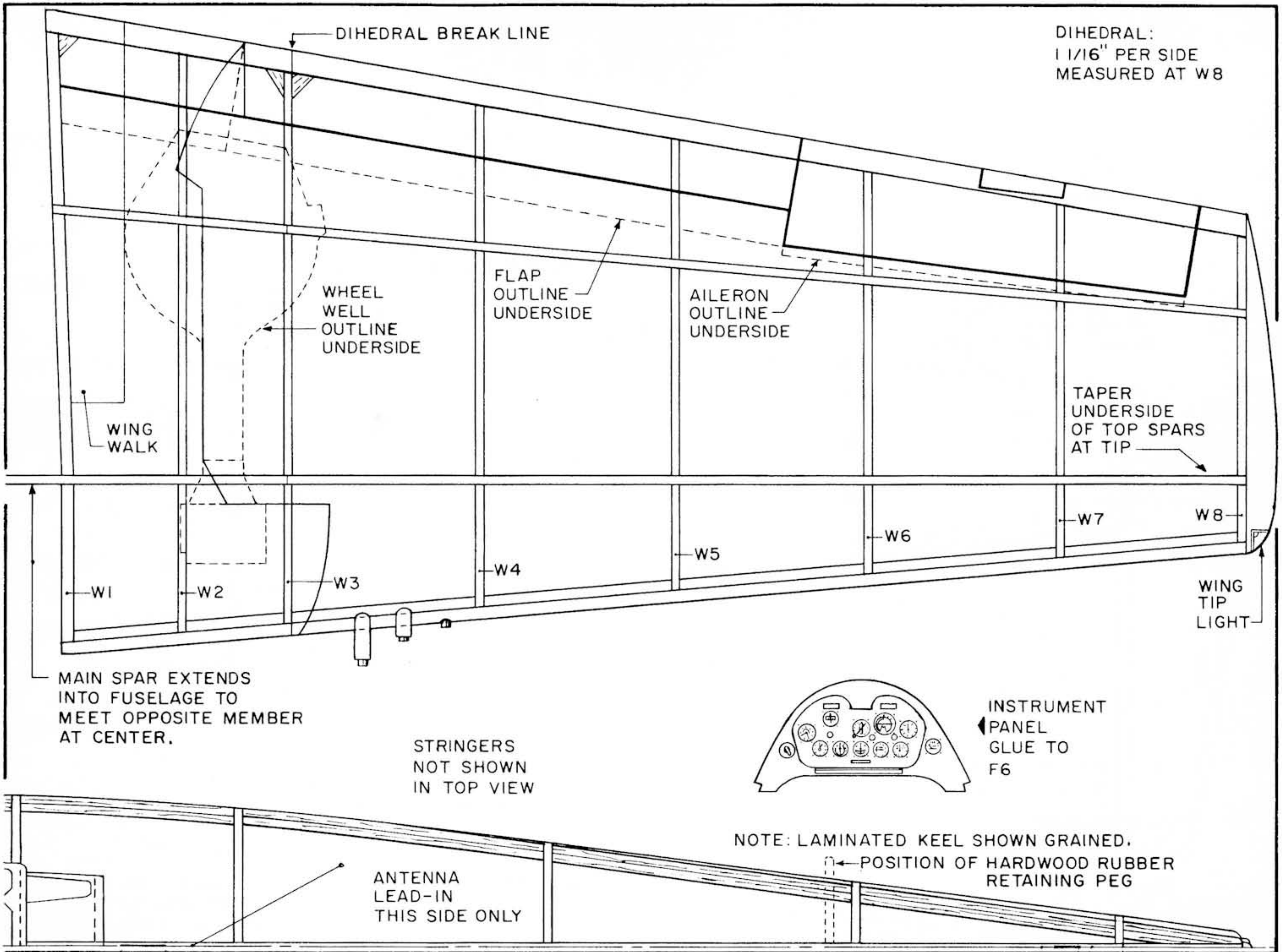
"AMERICAN AIRCRAFT MODELER," Grumman F6F-3 Hellcat drawing by Bjorn Karlstrom, September, 1969

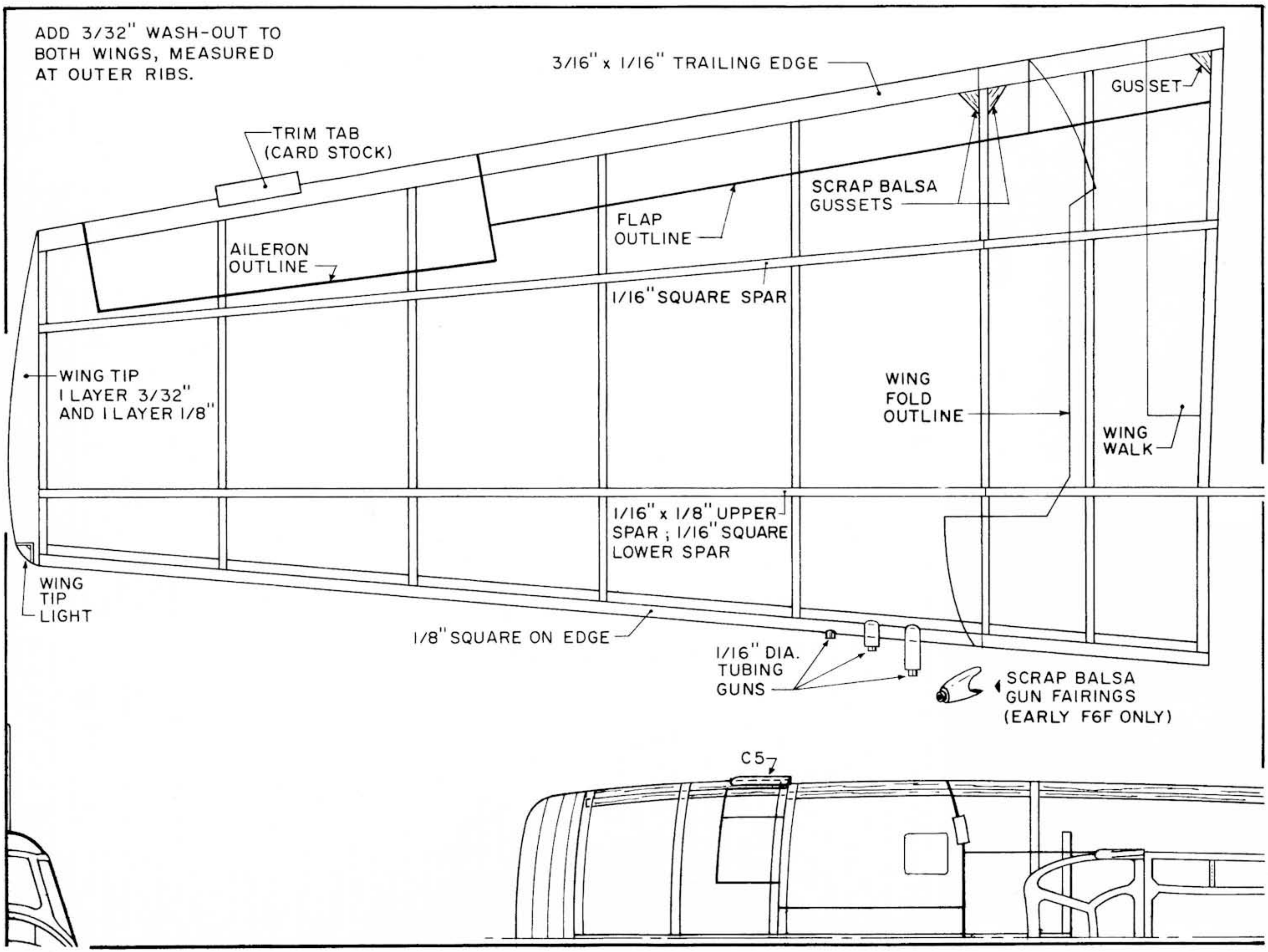

NOTE: Several plastic kits are on the market, and may prove helpful in visualizing various parts. Bear in mind, however, that they too are based upon human research and conclusions.


Special thanks to the following individuals for research aid: Mr. Thomas E. Doll, and Mr. Russ Barrera, of the Russ-Craft Model Museum. ●


FILL IN FUSELAGE FROM F6 FORWARD TO NOSE, WITH SOFT 1/16" SHEET.
DIAGONAL KEEL MEMBER. TEMPORARY ONLY, TO BE REMOVED AFTER STRINGERS ARE INSTALLED.
HARD 1/16" SHEET BALSA LANDING GEAR "SANDWICH"
13
C4
C3
C2
C1
F1
F2
F3
F4
F5
F6
C5
SCALE PROP HUB
SCALE PROP BLADE
.040 DIA. MUSIC WIRE LANDING GEAR LEG
MAKE ONE RIGHT AND ONE LEFT.
STRUTS ARE BUILT UP FROM BALSA AND PAPER STRIPS.
NOTE ANGLE
PECK-POLYMERS NYLON BEARING
NOSE PLUG
N1
N2
N3
N4
N5
COWLING KEEL
EXHAUST CHUTES VARIED IN SIZE AND SHAPE
MODIFIED 3/4" WILLIAMS BROS. CYLINDERS (9 REQUIRED)
BALANCE POINT
LANDING GEAR COVER (CARD STOCK) FORM AS SHOWN
WIRE STIFFENERS


DOTS OF GLUE
TO SIMULATE
INSULATORS
SILK THREAD
CARD STOCK OR
THIN WOOD
MASTS
R1
NOTE: ANTENNA CONFIGURATIONS VARIED
RUDDER
OUTLINE
NOTE: LAMINATED KEELS
SHOWN GRAINED
F8
F10
1/16" SQUARE
(TYPICAL)
R2
F7
F9
ANTENNA TO TIP OF
STAB
(BOTH
SIDES)
F11
F12
ELEVATOR
F13
WING
SADDLE
DETAILS FROM
SCRAP BALSA
AND CARD STOCK
NOTE: SOME FUSELAGE STRINGERS
OMITTED FOR CLARITY
PROTOTYPE MODEL WAS FLOWN WITH
A 7" DIAMETER KAYSUN PLASTIC
PROPELLER AND ONE LOOP OF
4 MM PIRELLI RUBBER.
TAIL WHEEL OUTLINE
AND STRUT
.025 MUSIC WIRE

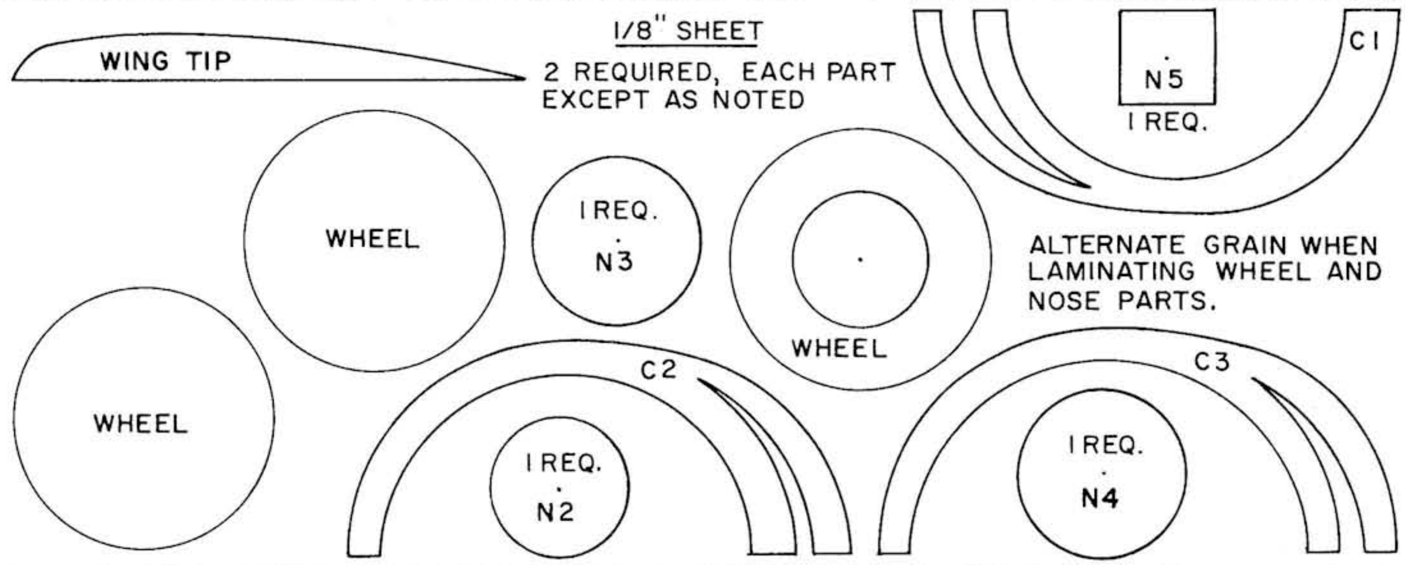

DIHEDRAL BREAK LINE
DIHEDRAL:
1 1/16" PER SIDE
MEASURED AT W8
WHEEL
WELL
OUTLINE
UNDERSIDE
FLAP
OUTLINE
UNDERSIDE
AILERON
OUTLINE
UNDERSIDE
TAPER
UNDERSIDE
OF TOP SPARS
AT TIP
WING
WALK
W1
W2
W3
W4
W5
W6
W7
W8
WING
TIP
LIGHT
MAIN SPAR EXTENDS
INTO FUSELAGE TO
MEET OPPOSITE MEMBER
AT CENTER.
STRINGERS
NOT SHOWN
IN TOP VIEW
INSTRUMENT
PANEL
GLUE TO
F6
NOTE: LAMINATED KEEL SHOWN GRAINED.
POSITION OF HARDWOOD RUBBER
RETAINING PEG
ANTENNA
LEAD-IN
THIS SIDE ONLY


ADD 3/32" WASH-OUT TO BOTH WINGS, MEASURED AT OUTER RIBS.
3/16" x 1/16" TRAILING EDGE
GUSSET
TRIM TAB (CARD STOCK)
SCRAP BALSA GUSSETS
FLAP OUTLINE
AILERON OUTLINE
1/16" SQUARE SPAR
WING TIP 1 LAYER 3/32" AND 1 LAYER 1/8"
WING FOLD OUTLINE
WING WALK
1/16" x 1/8" UPPER SPAR ; 1/16" SQUARE LOWER SPAR
WING TIP LIGHT
1/8" SQUARE ON EDGE
1/16" DIA. TUBING GUNS
SCRAP BALSA GUN FAIRINGS (EARLY F6F ONLY)
C5

1/8" SHEET

2 REQUIRED, EACH PART EXCEPT AS NOTED

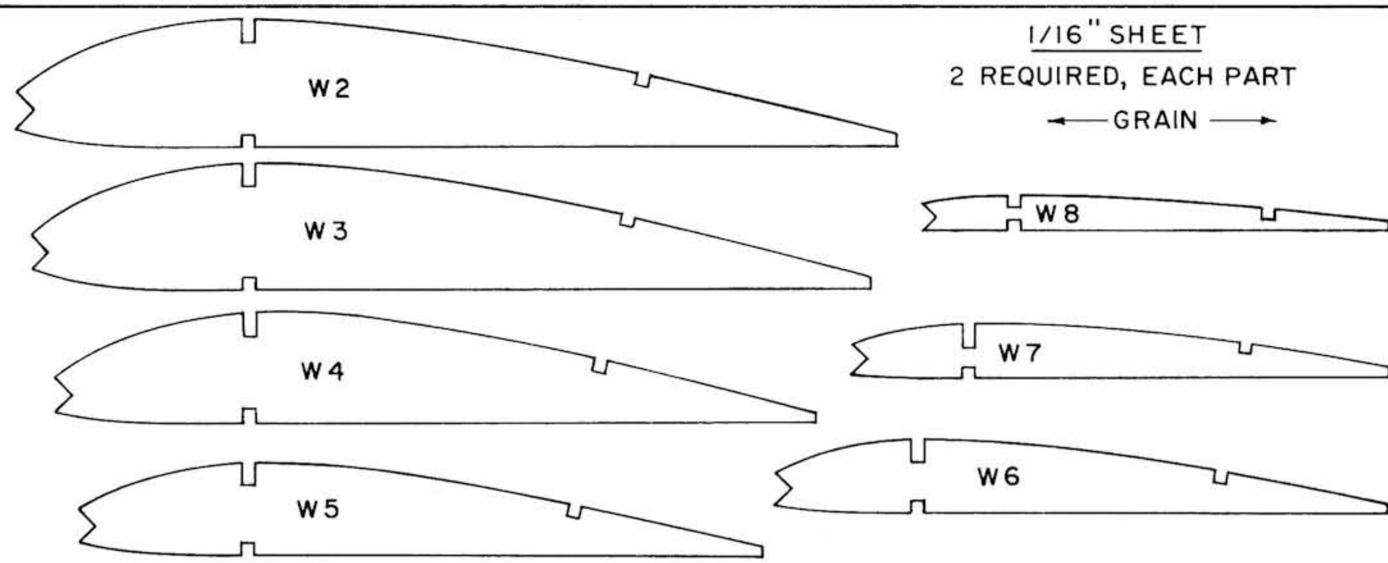
ALTERNATE GRAIN WHEN LAMINATING WHEEL AND NOSE PARTS.

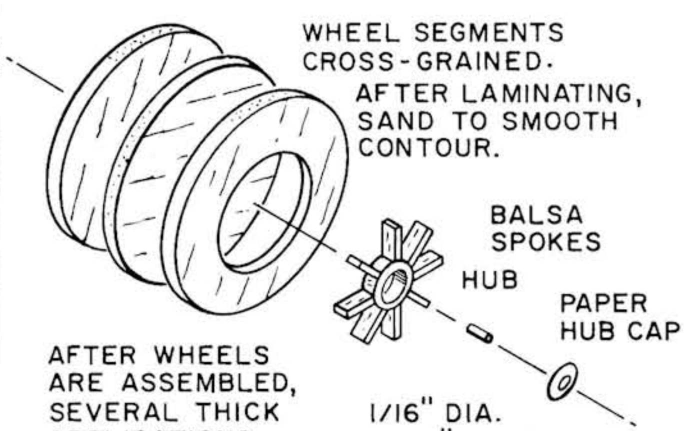



1/16" SHEET

2 REQUIRED, EACH PART

← GRAIN →




WHEEL SEGMENTS CROSS-GRAINED.

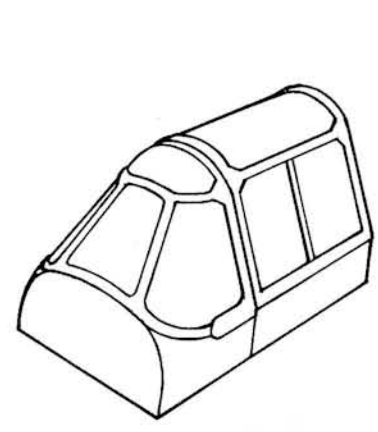
AFTER LAMINATING, SAND TO SMOOTH CONTOUR.

1/16" DIA. x 1/4" LONG ALUMINUM TUBE BEARING

AFTER WHEELS ARE ASSEMBLED, SEVERAL THICK APPLICATIONS OF PRIMER ARE USED TO SEAL THE GRAIN AND BUILD UP FILLETS AROUND THE SPOKES.

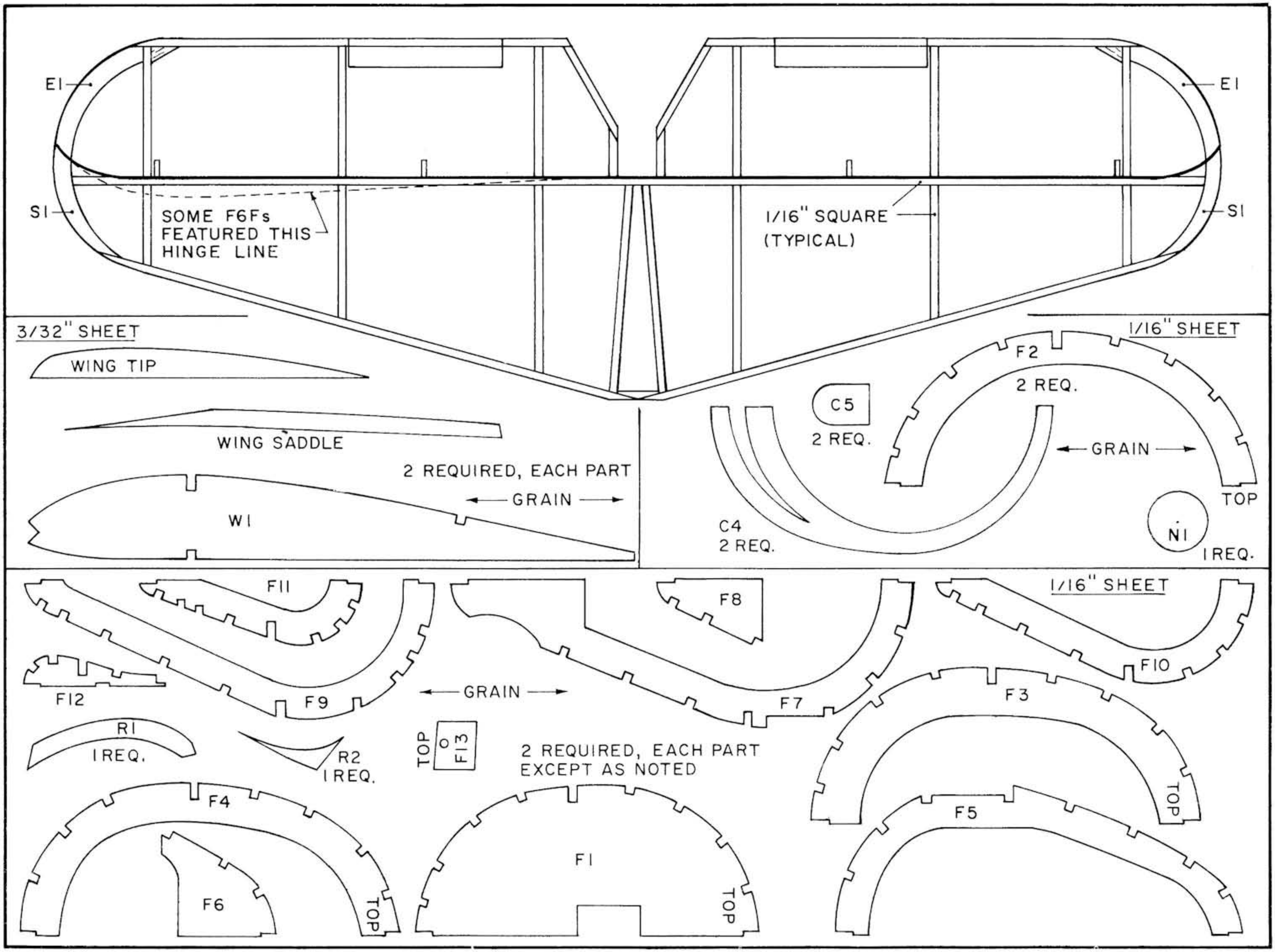
## WHEEL DETAILS

## CANOPY



CARVED BALSA COCKPIT FORM

SEAL GRAIN, ADD PAPER OR TAPE FRAMEWORK, SEAL, AND FORM CANOPY WITH VAC-U-FORM.


E1
E1
S1
S1
SOME F6Fs
FEATURED THIS
HINGE LINE
1/16" SQUARE
(TYPICAL)
3/32" SHEET
WING TIP
WING SADDLE
2 REQUIRED, EACH PART
GRAIN
W1
1/16" SHEET
F2
2 REQ.
C5
2 REQ.
GRAIN
TOP
C4
2 REQ.
N1
1 REQ.
F11
F8
1/16" SHEET
F12
F9
GRAIN
F7
F10
F3
R1
1 REQ.
R2
1 REQ.
TOP
F13
2 REQUIRED, EACH PART
EXCEPT AS NOTED
TOP
F4
F5
F6
F1
TOP
TOP

Taking the extra trouble to include the retractable landing gear covers in open position adds greatly to the realism of a model.

# VOUGHT F4U CORSAIR

**By FRANK SCOTT**

● The slip-stream howling through the wing root intakes caused the Japanese to call it "Whistling Death." Its unusual shape gave others to call it the "Bent Wing Bird," and its lineage of fine shipboard ancestors lent it the name . . . "Corsair."

First flown in 1940, the F4U Corsair was to become one of the most versatile and effective fighter aircraft of the Second World War, and production was therefore continued for eleven years. The airplane's trademark, its wing, was shaped thus to provide an aerodynamically clean fuselage/wing juncture and a more sturdy landing gear. The large propeller was turned by a Pratt & Whitney R-2800, which was the largest engine then available. This engine was eventually developed to deliver some 2,700 horsepower.

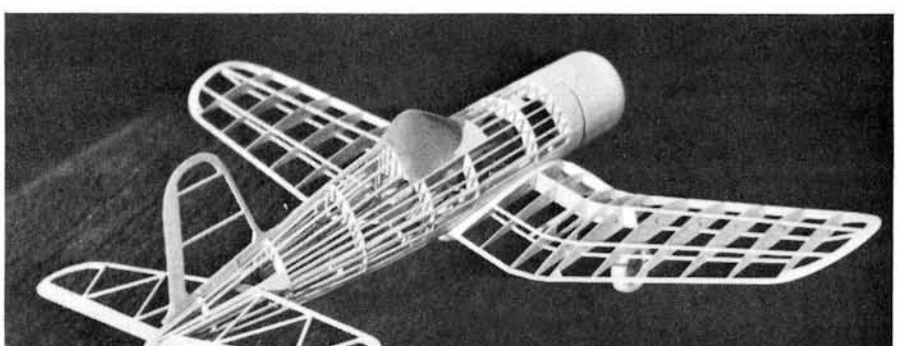
Besides its obvious, and highly successful career as a fighter, the Corsair became an excellent dive bomber, in which role up to 4,000 pounds of bombs were carried. Having no dive brakes, dive bombing F4U (and later AU-1) pilots checked their plunge by simply partially extending the landing gear.

The structure too, was unusual, as the fuselage employed an unusually smooth spot-welded skin (in lieu of rivets), and many Corsair stabilizers were of "Metalite," which was an aluminum-faced sandwich with a core of balsa wood . . . yet portions of the outer wing were fabric covered!

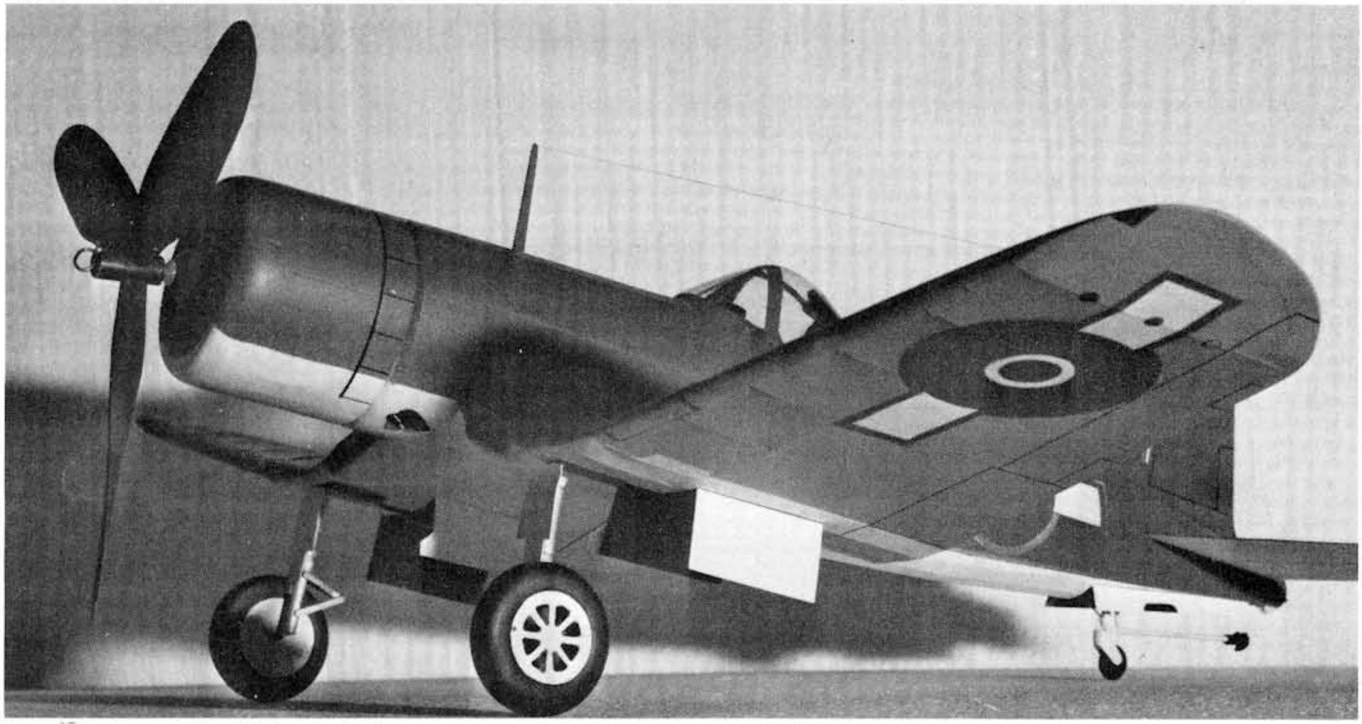
As a model subject, the Corsair is bound to raise a few eyebrows, and yet in truth, it is a better free flight choice than it might at first seem. The proportions, with the exception of the rather small horizontal stabilizer, are very good. Our model of the Corsair, while a little more difficult than the usual fighter-type rubber scale ship, does involve several procedures that may differ somewhat from tradition. For this reason then, we suggest that the following construction schedule be followed:

The wing is begun by fabricating the main spar. This part consists of a 1/16 inch sheet balsa center section with built up outer panel spars. A spar drawing is provided for your convenience on the plan. When this part may be handled, the center section ribs, R-1 through R-4, are set in place, followed by the center leading and trailing edges. Note that in order to simulate the Corsair's distinctive air scoops, the leading edge is cut away. Strength is maintained in this area by the sheet doublers behind the leading edge.

The wing is next propped up so that one outer panel may be pinned flat to the plan, and thus completed in the usual manner. The opposite wing will follow suit. Note that the leading edge spar is drawn extra deep. This allows the leading edge to be pinned directly to the plan without any shims. The



Structure of the Corsair is not complicated, but is a little tedious to complete. As usual, it is important that the tail surfaces be kept as light as possible. Note webbed main spar in wing.



Worm's eye view of Frank's Corsair model reveals the typical military two-tone paint job, the spoked wheels, insignia location, and recognition lights. Famous gull-wing configuration permitted larger propeller without long, ungainly landing gear struts.

extra material is easily trimmed away later, to conform to the Clark Y airfoil. When fitting the wing tips, note that the inboard end of the tip butts up with the lower portion of the end rib, while the very tip is raised to conform to the upper surface of the wing. The wing structure will be completed with the addition of the landing gear mounts, wing intake fairings, wing root sheeting and the various gussets. After sanding and installing the wire landing gear struts, the wing is ready for covering.

The fuselage is of familiar half-shell construction, using keels laminated from 1/16 inch square balsa . . . except that the fuselage is divided along the horizontal, rather than vertical plane. Thus, the top of the fuselage is assembled over the top view of the plan, and when the top is complete, the lower formers are added.

Adding the wing saddle pieces will ready the fuselage for mating with the wing. Subsequently, the remaining formers, keel, cowling pieces and stringers will complete the fuselage structure.

The cowling rings are glued together, cross-grain for strength, while the nose is filled in with sheet balsa in the interest of strength, balance, and appearance.

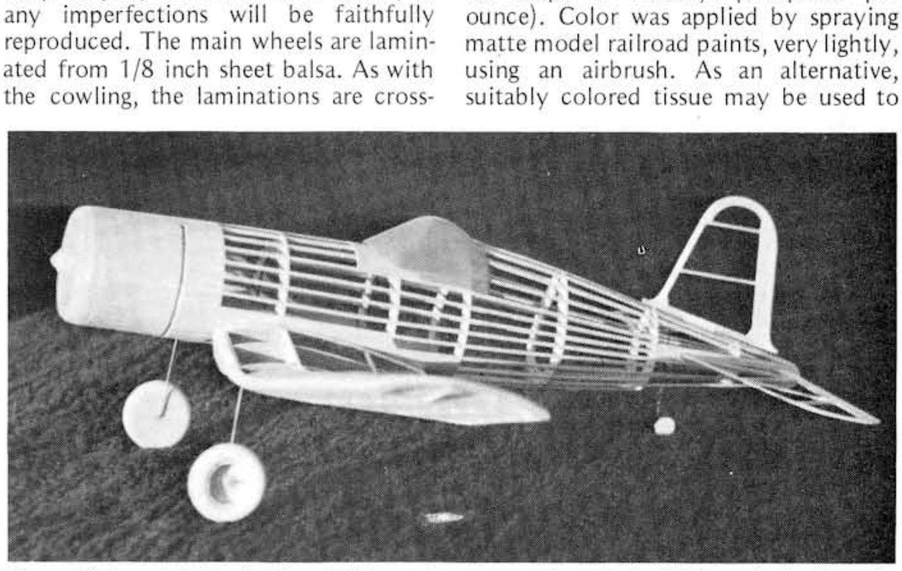
The nose plug may be produced by laminating discs, cross-grain of course, and sanding to final shape. Or alternately, a small model rocket nose cone may be employed. In either case, drill the nose plug to accept the Peck-Polymers thrust bushing. If desired, a dummy engine may be produced by gluing cylinders to the rear disc of the nose plug, N-5. Magnetos carved from scrap are secured to the "crankcase" portion of the nose plug. The installation of a Kaysun 7 inch propeller on its shaft, plus a couple of small washers, will complete the front end.

Turning our attention in the other direction, the tail surfaces are simple, flat strip structures. Careful sanding of these will afford a good savings of weight. Note that the same sheet pieces which locate the tailplane also serve to secure the rear motor peg. The wire tail skid is secured to the upper keel and supported by a balsa brace located between the horizontal keels. Motor access is then afforded through the copious tail wheel well.

The canopy is easily shaped using a Mattel Vac-U-Form toy, and a balsa block form. This form should be carefully shaped, smoothed and sealed, as any imperfections will be faithfully reproduced. The main wheels are laminated from 1/8 inch sheet balsa. As with the cowling, the laminations are cross-grained. The disc forms the back side of the wheel and the axle bearing is either a length of aluminum tubing or a cut down Peck-Polymers thrust bushing. After sanding to shape, the wheel thus formed is placed on its axle and secured with a small washer soldered to the axle. It is necessary that the remaining axle end be trimmed closely to allow the card wheel cover, cut away so as to simulate spokes, to be glued in place over the open face of the wheel.

With the wing and fuselage covered, the covered stabilizer is simply slipped into position in its slot, while the fin is cemented to the upper keel.

The entire model is given one or two coats of thinned, plasticized clear dope (we thin our dope about 50-50, adding 10 drops of tricresyl phosphate per ounce). Color was applied by spraying matte model railroad paints, very lightly, using an airbrush. As an alternative, suitably colored tissue may be used to



Minor adjustments in the bulkhead slots may be necessary in order to obtain perfectly straight stringer alignment, but the results are worth the trouble.

cover the model. However, we feel that the resulting translucency is inappropriate to a fighter of this era.

As this is a flying model, we now turn our attention to the necessities of flight. While our model was powered by six strands of 1/8 inch rubber, this airplane may easily be adapted to use the Brown $CO_2$ engine. The hole in the nose bulkhead is of ample size to permit a tray-like structure, incorporating mounts for the engine, $CO_2$ tank and filler valve, to be easily inserted interchangeably with the rubber model nose block.

Regardless of power model chosen, flight adjustments will be of a similar nature. Begin by establishing the balance point as shown on the plans. Bits of modeling clay can be stuck inside the nose bulkhead or tail wheel well as needed to achieve balance and yet not detract from appearance. With the model correctly balanced, the next step is to gently hand glide it, during a calm day, over the legendary but usually unavailable tall grass. The glide may then be trimmed by bending the trailing edge of the stabilizer up or down as needed. (There, now you know what that wide trailing edge is for!) Likewise, turns may be dealt with by deflecting the trailing edge of the fin.

These few procedures should take care of the glide, but before winding the motor, place a 3/32 inch thick shim behind the upper left portion of the nose block in order to achieve a bit of right and down thrust so as to prevent zooming turns into the ground. As the turns wound into the motor are increased, it will be necessary to change the thrust line accordingly. Though this Corsair will R.O.G. very well, we encourage hand launches, due to the vulnerable nature of the landing gear doors and such details.

## REFERENCES


Aircraft in Profile
Vol. 47 Vought F4U-1 Corsair
Vol. 150 F4U-4 to F4U-7 Corsair
Doubleday & Company, Inc.
Garden City, New York

Famous Fighters of the Second World War
Vol. 2
William Green
Hanover House
New York, New York

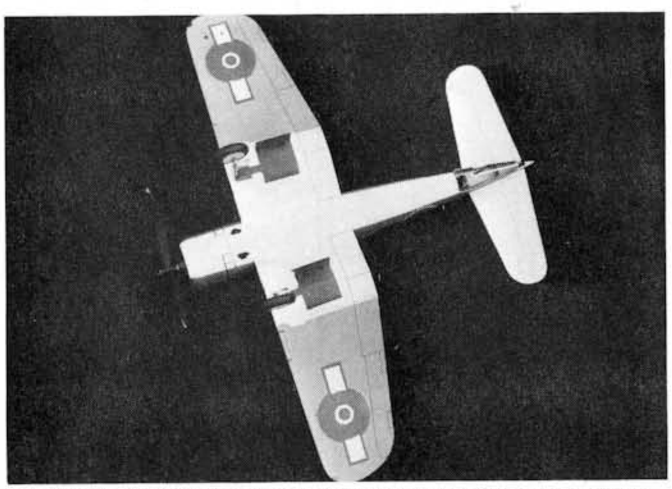
Warplanes of the Second World War, Fighters
Vol. 4
William Green
MacDonald & Co.
London, England

American Aircraft Modeler Magazine
October, 1968, P.P. 38B and C
733 15th Street, N.W.
Washington, District of Columbia, 20005

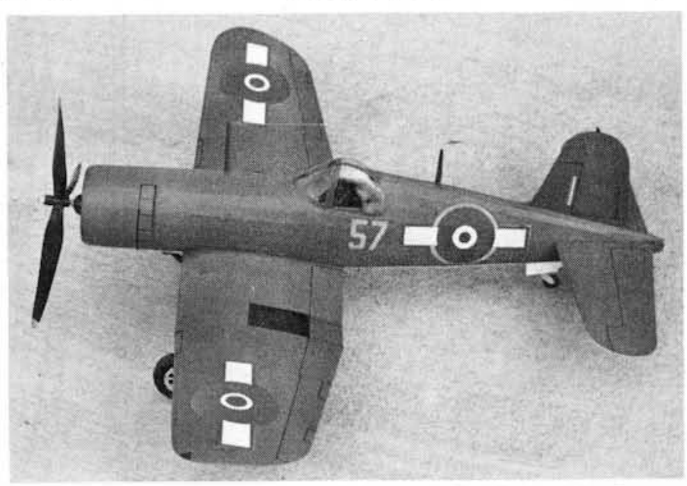
Scale Plastic Kits:

Frog Kit No. F243F 1/72 Scale
"Chance Vought Corsair"

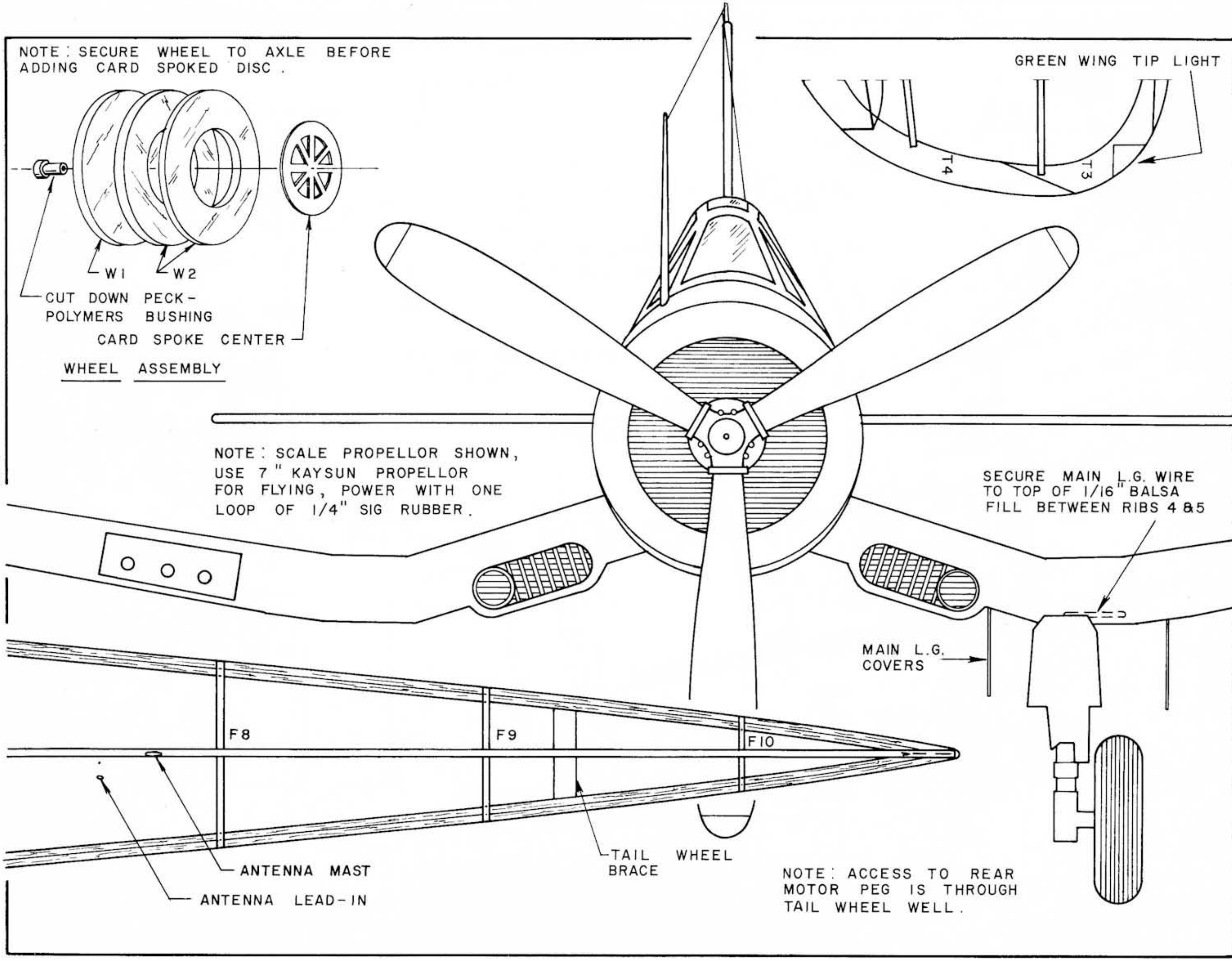
Revell Kit No. H-278 1/32 Scale
"Corsair F4U-1"

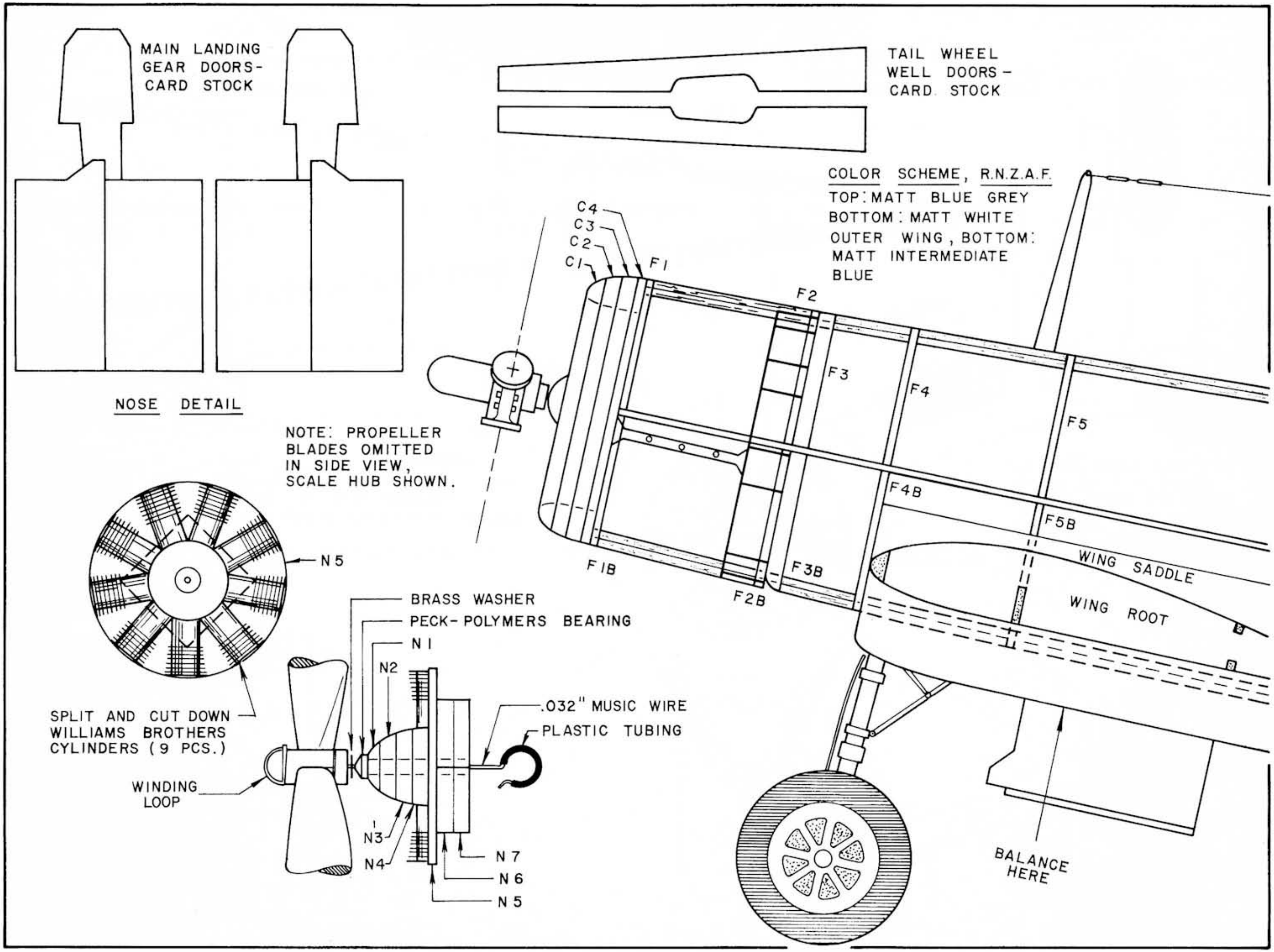



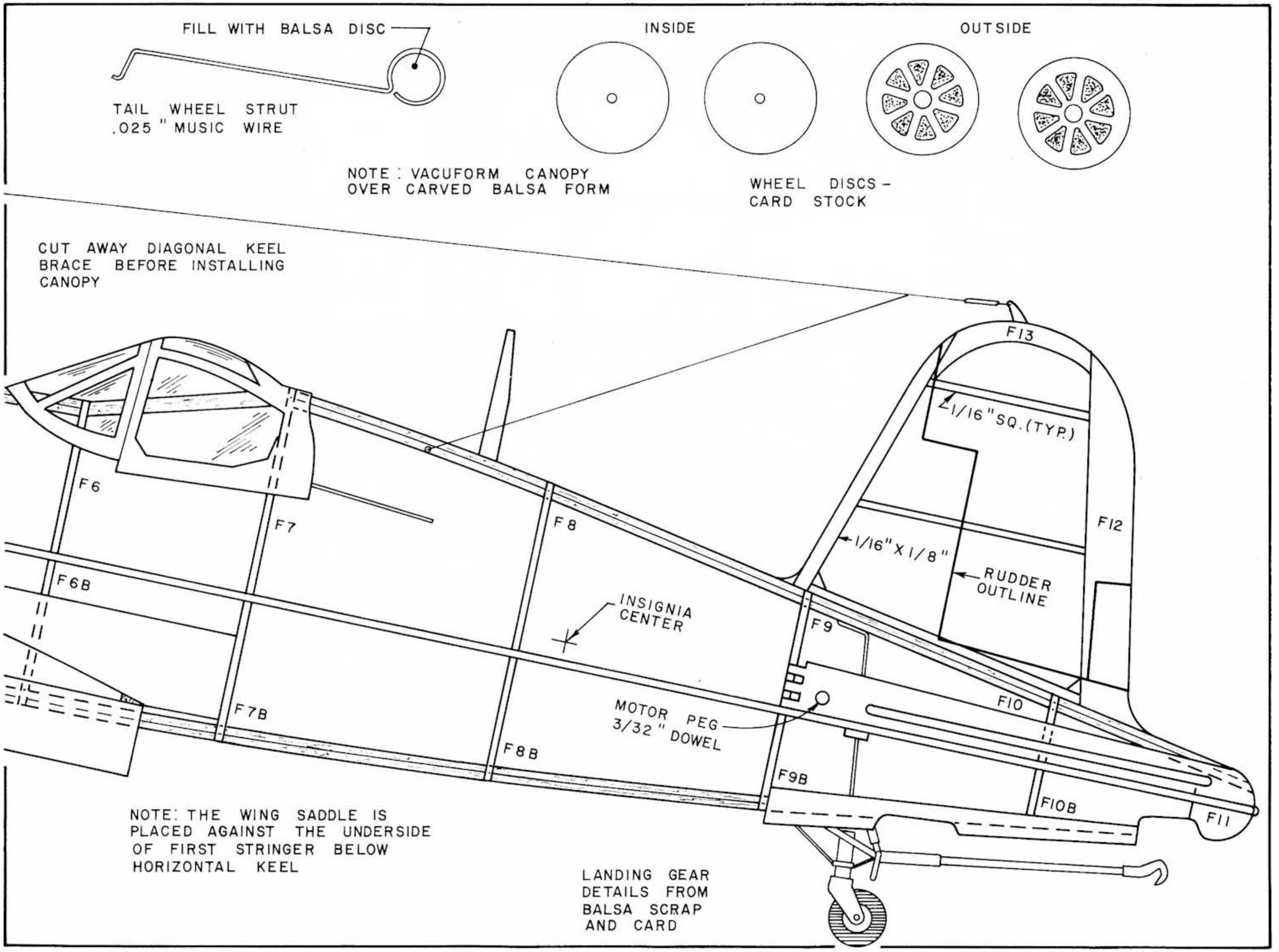
Complete underside view of paint, markings, panel lines, and insignia.




Ship is decorated in the colors of the Royal New Zealand Air Force.

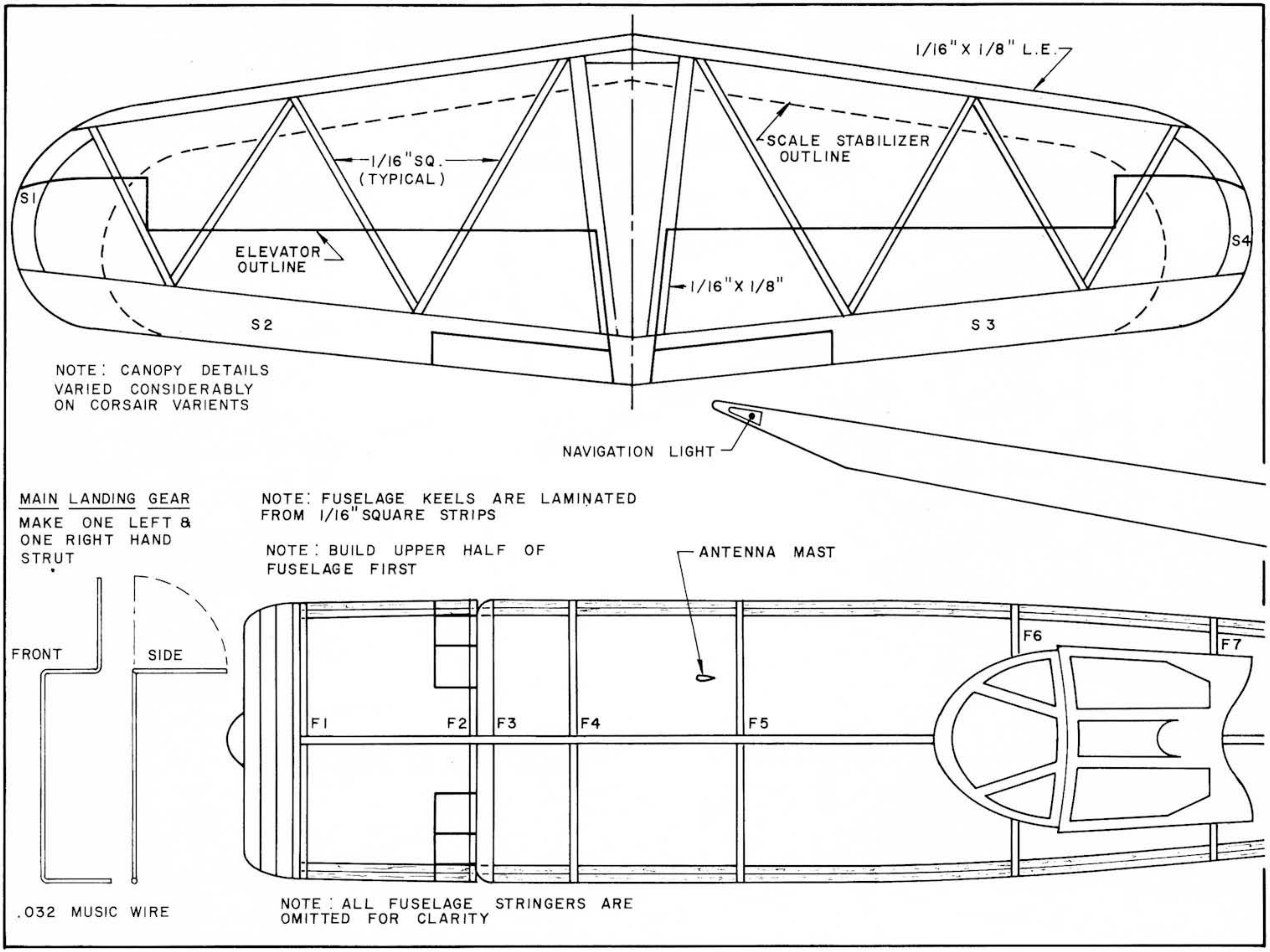

NOTE: SECURE WHEEL TO AXLE BEFORE ADDING CARD SPOKED DISC.
W1
W2
CUT DOWN PECK-POLYMERS BUSHING
CARD SPOKE CENTER
WHEEL ASSEMBLY
GREEN WING TIP LIGHT
T4
T3
NOTE: SCALE PROPELLOR SHOWN, USE 7" KAYSUN PROPELLOR FOR FLYING, POWER WITH ONE LOOP OF 1/4" SIG RUBBER.
SECURE MAIN L.G. WIRE TO TOP OF 1/16" BALSA FILL BETWEEN RIBS 4 & 5
MAIN L.G. COVERS
F8
F9
F10
ANTENNA MAST
ANTENNA LEAD-IN
TAIL WHEEL BRACE
NOTE: ACCESS TO REAR MOTOR PEG IS THROUGH TAIL WHEEL WELL.

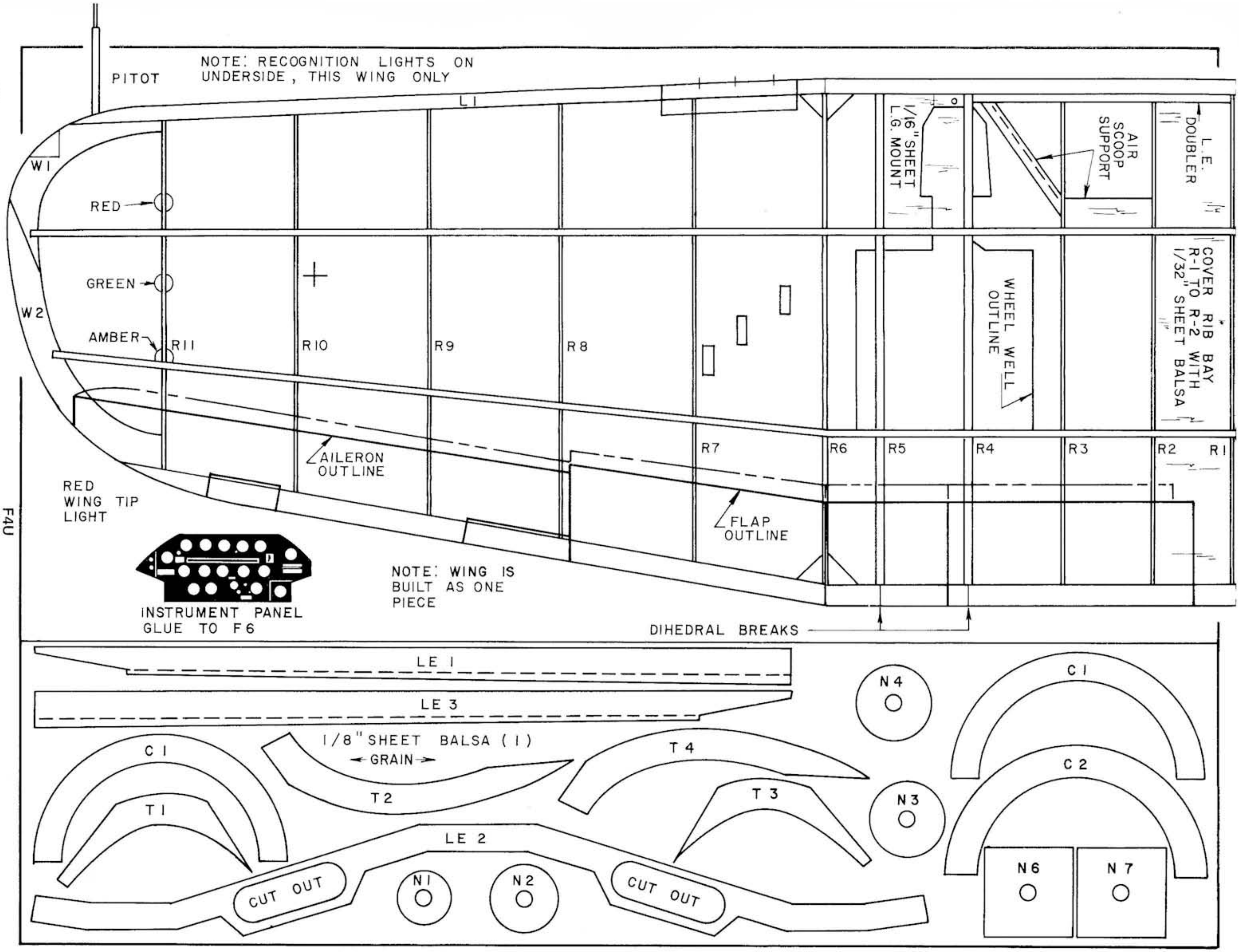

MAIN LANDING GEAR DOORS- CARD STOCK
TAIL WHEEL WELL DOORS - CARD STOCK
COLOR SCHEME, R.N.Z.A.F.
TOP: MATT BLUE GREY
BOTTOM: MATT WHITE
OUTER WING, BOTTOM: MATT INTERMEDIATE BLUE
NOSE DETAIL
NOTE: PROPELLER BLADES OMITTED IN SIDE VIEW, SCALE HUB SHOWN.
C4
C3
C2
C1
F1
F2
F3
F4
F5
F4B
F5B
F1B
F2B
F3B
WING SADDLE
WING ROOT
N5
BRASS WASHER
PECK-POLYMERS BEARING
N1
N2
.032" MUSIC WIRE
PLASTIC TUBING
SPLIT AND CUT DOWN WILLIAMS BROTHERS CYLINDERS (9 PCS.)
WINDING LOOP
N3
N4
N7
N6
N5
BALANCE HERE

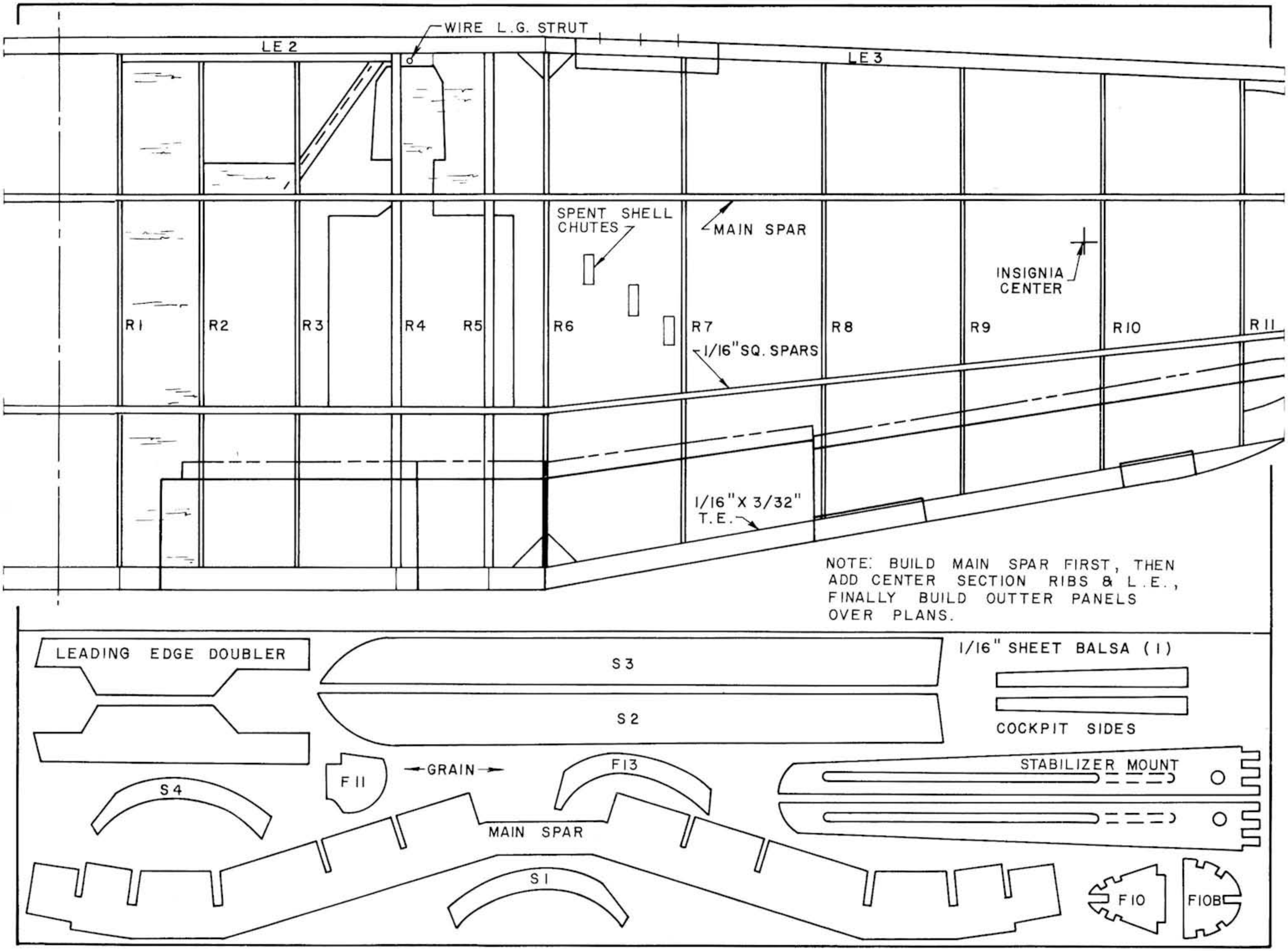


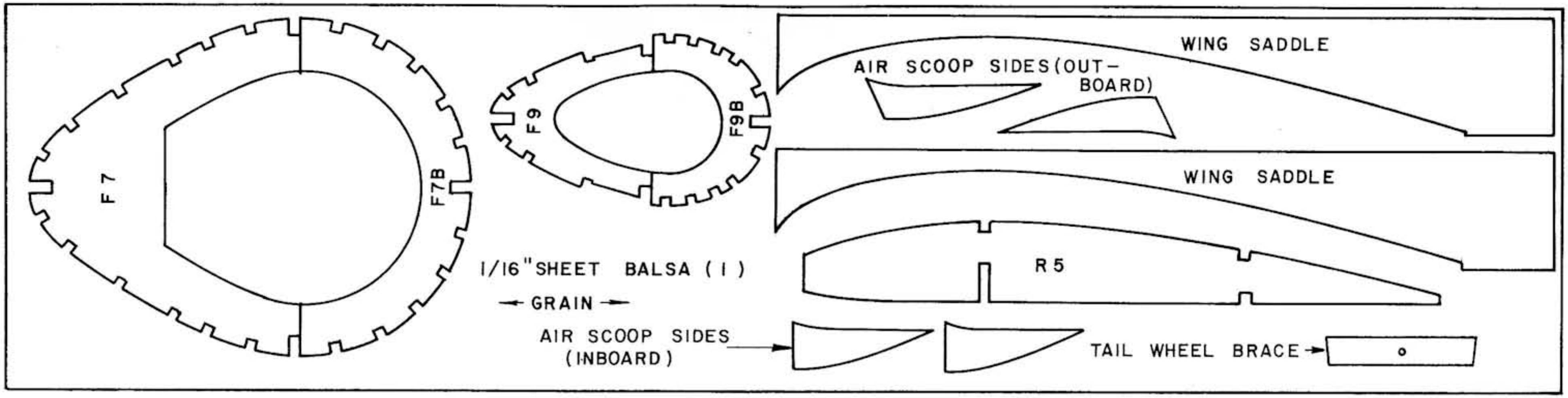
FILL WITH BALSA DISC
TAIL WHEEL STRUT
.025 " MUSIC WIRE
INSIDE
OUTSIDE
NOTE : VACUFORM CANOPY
OVER CARVED BALSA FORM
WHEEL DISCS -
CARD STOCK
CUT AWAY DIAGONAL KEEL
BRACE BEFORE INSTALLING
CANOPY
F13
1/16" SQ. (TYP.)
F6
F7
F8
F12
1/16" X 1/8"
RUDDER
OUTLINE
F6B
INSIGNIA
CENTER
F9
F10
MOTOR PEG
3/32 " DOWEL
F7B
F8B
F9B
F10B
F11
NOTE: THE WING SADDLE IS
PLACED AGAINST THE UNDERSIDE
OF FIRST STRINGER BELOW
HORIZONTAL KEEL
LANDING GEAR
DETAILS FROM
BALSA SCRAP
AND CARD

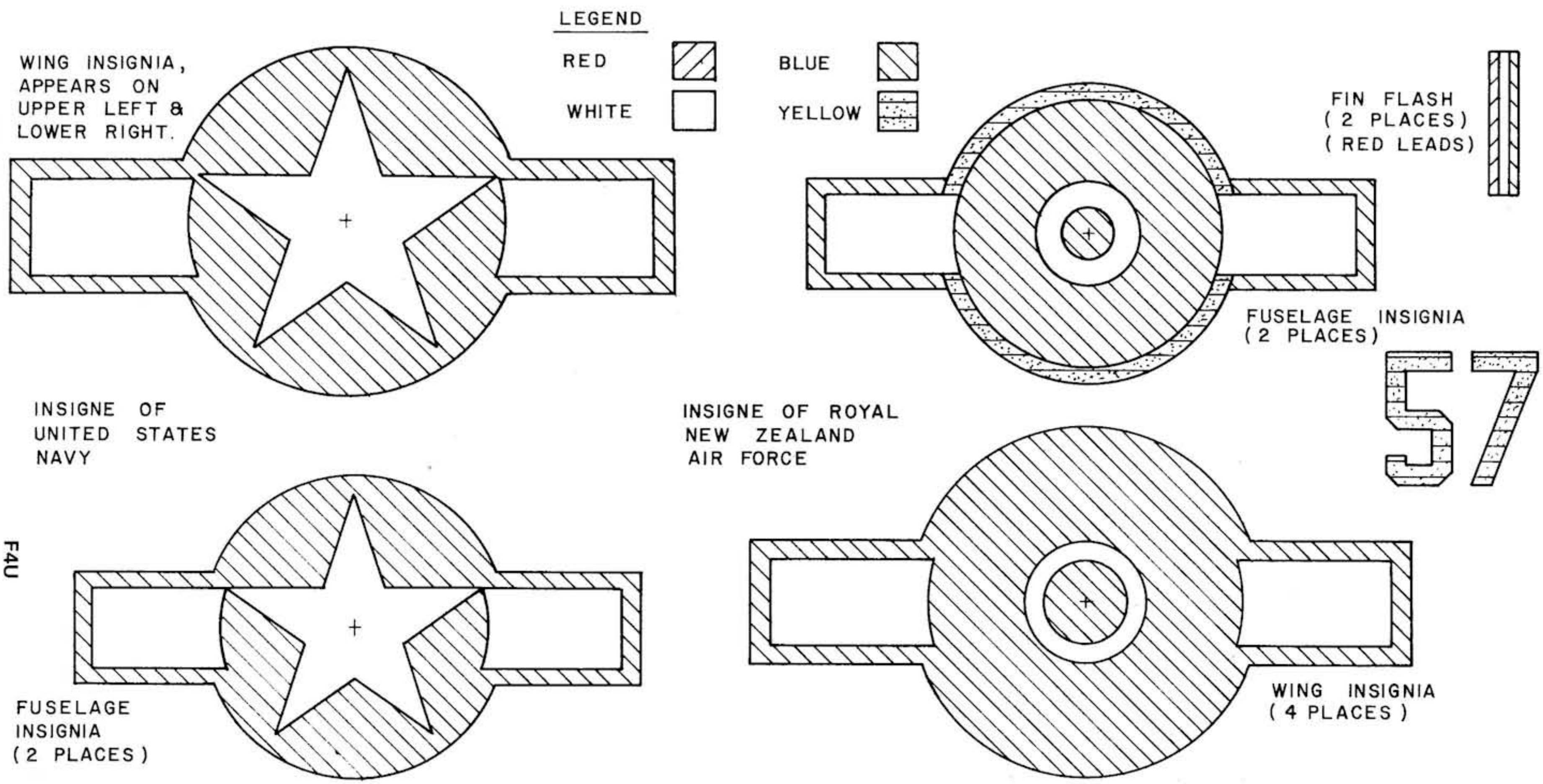
F4U

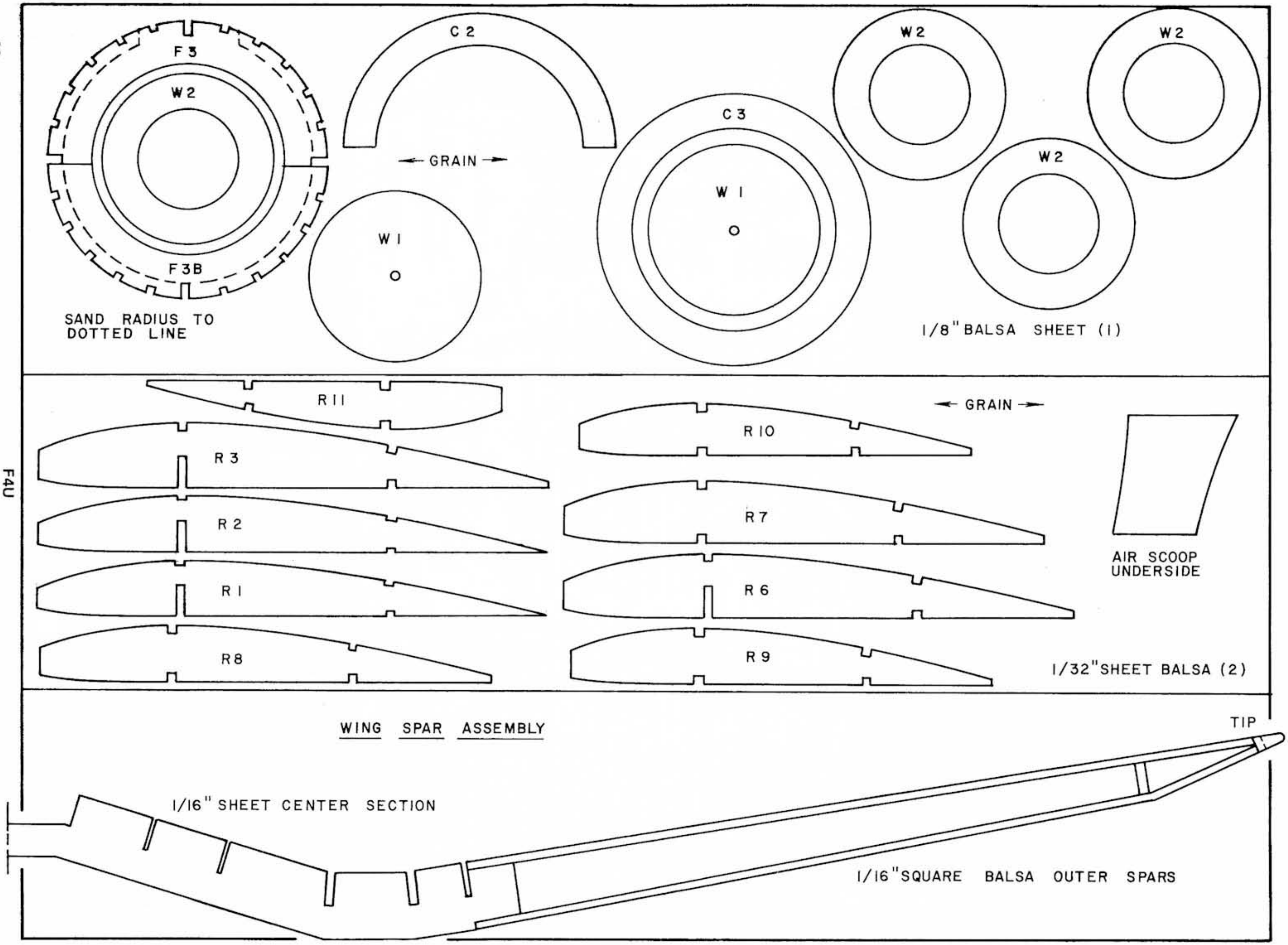

1/16" X 1/8" L.E.
SCALE STABILIZER OUTLINE
1/16" SQ. (TYPICAL)
S1
S4
ELEVATOR OUTLINE
1/16" X 1/8"
S2
S3
NOTE: CANOPY DETAILS VARIED CONSIDERABLY ON CORSAIR VARIENTS
NAVIGATION LIGHT
MAIN LANDING GEAR
MAKE ONE LEFT & ONE RIGHT HAND STRUT
NOTE: FUSELAGE KEELS ARE LAMINATED FROM 1/16" SQUARE STRIPS
NOTE: BUILD UPPER HALF OF FUSELAGE FIRST
ANTENNA MAST
FRONT
SIDE
F6
F7
F1
F2
F3
F4
F5
.032 MUSIC WIRE
NOTE: ALL FUSELAGE STRINGERS ARE OMITTED FOR CLARITY

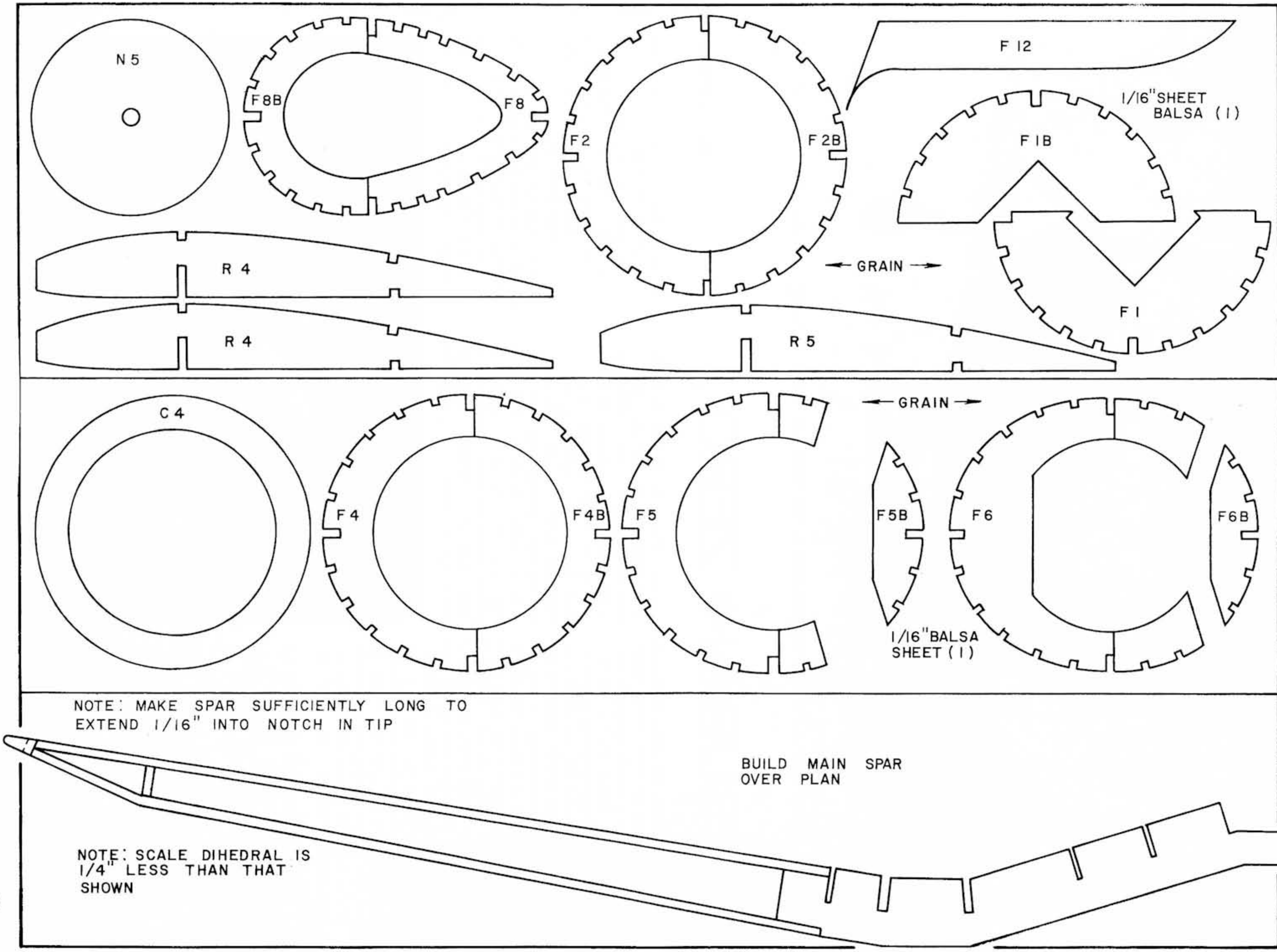

PITOT
NOTE: RECOGNITION LIGHTS ON UNDERSIDE, THIS WING ONLY
L1
W1
W2
RED
GREEN
AMBER
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
1/16" SHEET L.G. MOUNT
AIR SCOOP SUPPORT
L.E. DOUBLER
WHEEL WELL OUTLINE
COVER RIB BAY R-1 TO R-2 WITH 1/32" SHEET BALSA
AILERON OUTLINE
FLAP OUTLINE
RED WING TIP LIGHT
INSTRUMENT PANEL GLUE TO F6
NOTE: WING IS BUILT AS ONE PIECE
DIHEDRAL BREAKS
LE 1
LE 3
LE 2
1/8" SHEET BALSA (1)
GRAIN
C 1
C 2
T 1
T 2
T 3
T 4
N 1
N 2
N 3
N 4
N 6
N 7
CUT OUT
CUT OUT

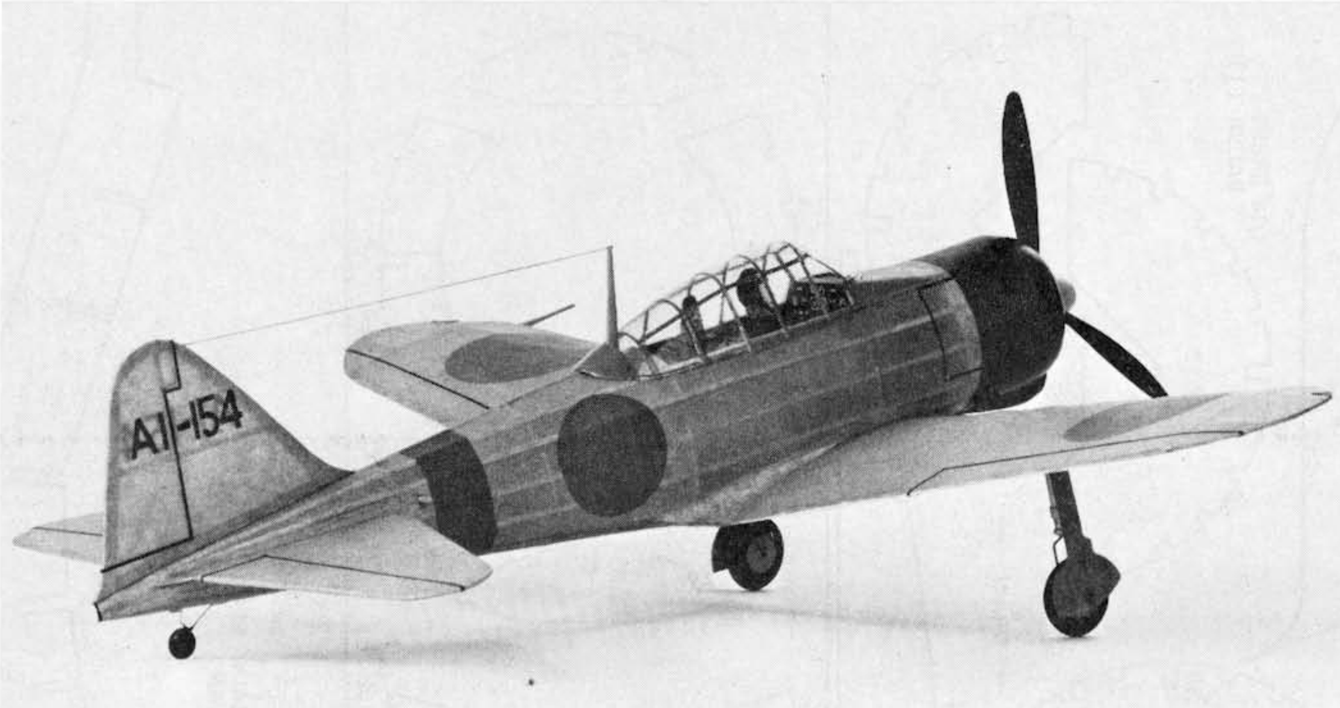

WIRE L.G. STRUT
LE 2
LE 3
SPENT SHELL CHUTES
MAIN SPAR
INSIGNIA CENTER
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
1/16" SQ. SPARS
1/16" X 3/32" T.E.
NOTE: BUILD MAIN SPAR FIRST, THEN ADD CENTER SECTION RIBS & L.E., FINALLY BUILD OUTTER PANELS OVER PLANS.
LEADING EDGE DOUBLER
S 3
S 2
1/16" SHEET BALSA (1)
COCKPIT SIDES
F 11
GRAIN
F13
STABILIZER MOUNT
S 4
MAIN SPAR
S 1
F 10
F10B


F 7
F7B
F 9
F9B
WING SADDLE
AIR SCOOP SIDES (OUT-BOARD)
WING SADDLE
R 5
1/16" SHEET BALSA ( I )
← GRAIN →
AIR SCOOP SIDES (INBOARD)
TAIL WHEEL BRACE


LEGEND
RED
WHITE
BLUE
YELLOW
WING INSIGNIA, APPEARS ON UPPER LEFT & LOWER RIGHT.
FIN FLASH ( 2 PLACES ) ( RED LEADS )
FUSELAGE INSIGNIA ( 2 PLACES )
57
INSIGNE OF UNITED STATES NAVY
INSIGNE OF ROYAL NEW ZEALAND AIR FORCE
FUSELAGE INSIGNIA ( 2 PLACES )
WING INSIGNIA ( 4 PLACES )


F 3
W 2
F 3B
SAND RADIUS TO DOTTED LINE
C 2
← GRAIN →
W I
C 3
W I
W 2
W 2
W 2
1/8" BALSA SHEET (1)
R II
R 3
R 2
R I
R 8
← GRAIN →
R 10
R 7
R 6
R 9
AIR SCOOP UNDERSIDE
1/32" SHEET BALSA (2)
WING SPAR ASSEMBLY
TIP
1/16" SHEET CENTER SECTION
1/16" SQUARE BALSA OUTER SPARS


N 5
F8B
F8
F2
F 2B
F 12
1/16" SHEET BALSA (1)
F 1B
F 1
GRAIN
R 4
R 4
R 5
C 4
F 4
F 4B
F 5
F5B
F 6
F6B
GRAIN
1/16" BALSA SHEET (1)
NOTE: MAKE SPAR SUFFICIENTLY LONG TO EXTEND 1/16" INTO NOTCH IN TIP
BUILD MAIN SPAR OVER PLAN
NOTE: SCALE DIHEDRAL IS 1/4" LESS THAN THAT SHOWN




**The famous Japanese "Zero" as it appeared during the attack on Pearl Harbor, Dec. 7, 1941, was this Mitsubishi A6MS Type O, Model 21.**

# MITSUBISHI ZERO

**By BOB PECK**

● The Zero was the most important Japanese airplane of WWII. At the beginning of the war it was far advanced compared to the Allied planes and had developed a reputation of being invincible. Because of its light and simple construction it was extremely maneuverable and had tremendous range. It was not until the capture of a nearly intact Zero in 1942 that the invincible Zero myth was to end. In September 1942, full reports of the Zero's shortcomings were released to the American pilots, and soon the stronger American aircraft took the advantage over the Zeros. As the war proceeded, the Japanese continually improved the Zero, but it was too late, and finally, during the last months of the war they were used in mass suicide attacks on the U.S. naval task forces.

The Zero chosen for this model airplane is the Mitsubishi A6MS Type O, Model 21 which was used in the attack on Pearl Harbor December 7, 1941.

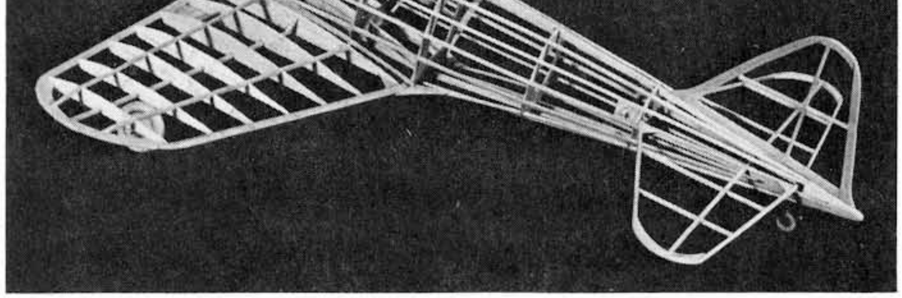
Specifications:

Wing span – 36 ft. 1 in.
Length – 29 ft. 9 in.
Engine – Nakajima 940 H.P.
Maximum Speed – 317 MPH
Armament – 2 - 20 mm Cannons
2 - 7.7 mm Machine Guns

CONSTRUCTION

The wing, stabilizer, and rudder are of standard construction. Tape down the plan and cover it with wax paper or plastic wrap so that glue will not stick to it. Sheets 5 and 6 of the plan contain all the part layouts and wood thicknesses. It is suggested that you have these sheets copied so you can tape them down over the wood and cut out the parts through the copy with a sharp modeler's knife or razor blade. Pin parts down to plan and glue together. Leave top spars and gussets off wing until after dihedral is formed. Note: Add washout to wing tips when gluing in dihedral as this will improve the stability of the plane. Before covering wing, glue 1/32 inch wire landing gear to wing formers W-11. Use plenty of glue or epoxy on top and bottom of W-11, where the wire goes through, as this is a high stress area.

The fuselage construction is of the half-shell type and goes together much easier than it may appear. First, pin down keel parts to the plan. Now add the "A" half of formers F-7 to F-14 and the stringers, and let dry thoroughly.



**Framework shot of the Zero reveals the typical half-shell fuselage construction, sheet fill-in around the nose, and extra light tail surfaces. Canopy was vacuum formed.**


How's this for realism? Bob's Zero climbs out steadily after takeoff. Note two-bladed Kaysun prop used for flying. A seven inch prop cut down to six works best. Includes free-wheeling hub.

After removing from plan, glue other half of formers to opposite side and add stringers.

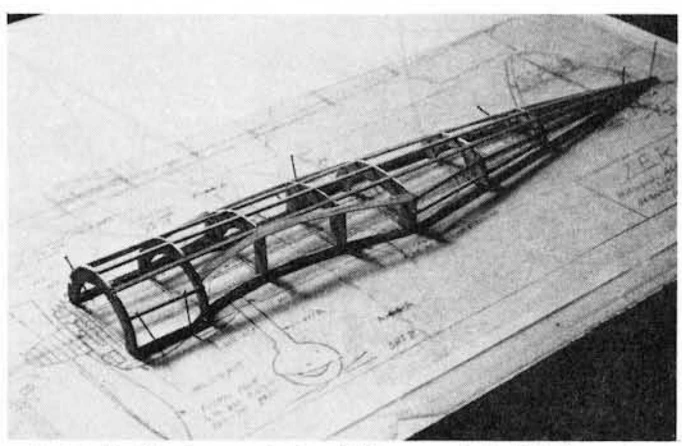
By the way, we glued the paper copy of the formers to the 1/32 balsa sheet to add strength and make the parts easier to cut out without splitting the wood. Remove the section of keel between F-9 and F-10 in cockpit area to add cockpit detail, if you wish. Fill in front of fuselage with sheet balsa as shown and add 1/8 inch thick formers N-1, N-2, N-3, and sand to shape. Do not fill in sheet wood around horizontal stabilizer until after model has been test flown and trimmed by adjusting stabilizer in this slot. The stabilizer can be held in place with rubber cement and balsa shims until final position is determined.

The nose block and wheels are made of 1/8 inch sheet balsa and use nylon bearings, available from Peck-Polymers, Box 2498, La Mesa, Calif. 92041. A package of 4 is 50 cents, postpaid. A scale propeller is made up of 1/8 inch sheet balsa blades. For flying, use a 6 inch dia. Kaysun plastic propeller or 7 inch Kaysun, cut down to 6 inch dia. The 7 inch Kaysun has a built-in free wheeling hub and a little more area for efficiency and weight to help balance the plane. Carefully sand the heaviest blade, as most plastic propellers are quite out of balance.

The canopy on our model was molded from clear plastic sheet on a Mattel Vac-U-Form. In order to fit the Mattel Vac-U-Form, the canopy had to be made in three pieces. Glue three blocks of balsa together with a piece of paper between each joint and then carve the canopy as one piece. Lay out the balsa mold with the front and back sections 1/16 inch longer to allow enough length for gluing the plastic parts together; also make the mold 1/8 inch higher on bottom to permit trimming the plastic after molding. Finish the male balsa mold with two or three coats of fiberglass casting resin, sanding between coats. This will give the mold a strong, heat-resistant coating for vacuum forming. Now cut the mold apart at the paper/glue joints, which will separate easily and cleanly. The parts may then be vacuum formed, cut out, and glued together to form the canopy. The easiest way to put the structure lines on the canopy is to use 1/16 inch wide silver tape, available at stationery stores. Put the tape on the inside of the canopy to prevent it from being pulled off.

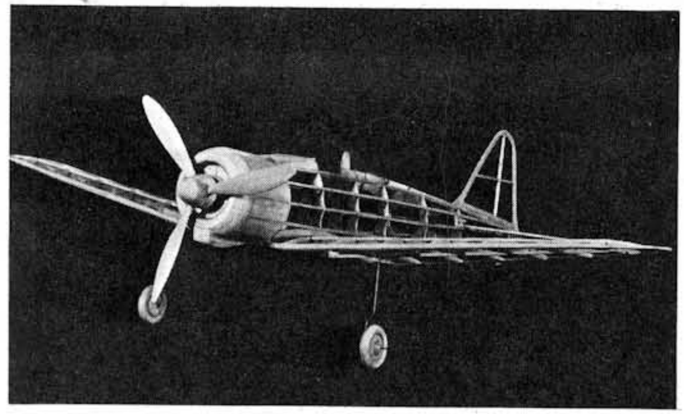
The plane is now ready for finishing. Do not assemble wing, stabilizer, rudder and fuselage until after they have been covered. Before covering, paint the structure with a couple of coats of clear dope or you may have trouble getting the tissue to stick. We prefer using colored tissue and finishing with 2 coats of clear dope thinned about 50%. If


The Zero is an excellent flying model, following its prototype in being lightly constructed and having clean lines.



Left half of fuselage on the board illustrates the half-shell construction at an early stage.

**The Zero in another typically stable flight.**



**As with the full size ship, the framework is extremely light. Note scalloped formers for smooth covering. Canopy vacuum formed.**

you have trouble finding tissue the color you want, Marlow Engineering, 6850 Vineland Ave., North Hollywood, Calif. 91605, sells a variety that should meet your need. The color scheme on the plan is only one of several used on the Zero. Another is as follows: Olive green upper surfaces, light gray lower surfaces, black cowling, gray spinner, dull black blades. Still another color scheme, used primarily on Zero trainers, is overall orange with dark blue cowling, gray spinner, dull black blades. The references listed at the end of the article show other color schemes and markings.

The insignia and other markings are cut from colored tissue and applied with clear dope. For control outlines, use 1/32 inch wide black tape available from hobby and stationery stores.

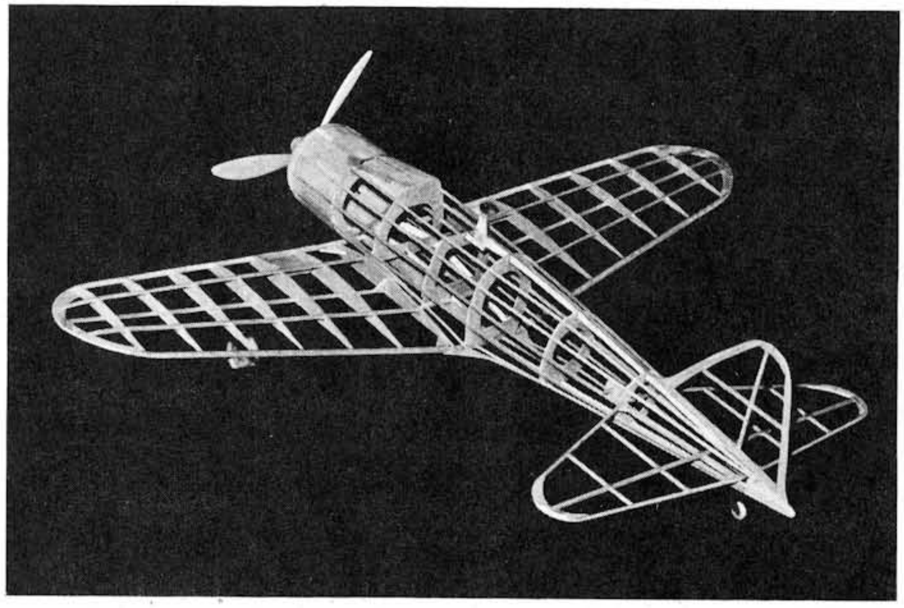
Now comes the moment of truth . . . "Will it fly?" First check for warps, and if found, remove by holding the surface over steam, bending in opposite direction and holding until cool. Repeat until surfaces are corrected. Next, check balance and add weight fore or aft until model balances as shown on plan. Be sure that when balancing you have the flying prop installed and a loop of 1/8 inch rubber about 11 inches long. Also note here that the nose plug should be a very tight fit with the fuselage, or it will fall out and ruin the model's glide. For test gliding small rubber model, we like to put in 15 to 25 turns so that the prop is not adding drag that may prevent a true evaluation of the model's performance. Test flying should be done in calm air and, as always, launch model into the wind if there is any. Adjust model with the horizontal stabilizer, as mentioned before, until the model has a smooth glide, neither diving or stalling.

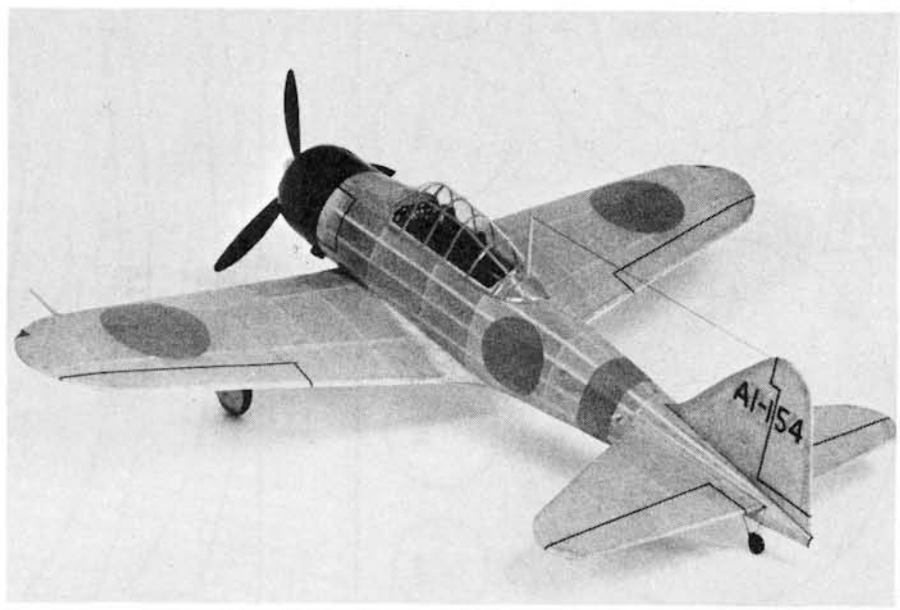
Total weight with flying propeller and rubber motor was one ounce; the only adjustment needed was about $1^{o}$ more downthrust. The model flew very well, with a stable climb and slow glide, using one 12 inch long loop of 3 mm (1/8 inch) Pirelli rubber. The best combination of power will vary depending on the weight of the model, propeller selected, and whether you want a fast climb or long slow motor run.

REFERENCES

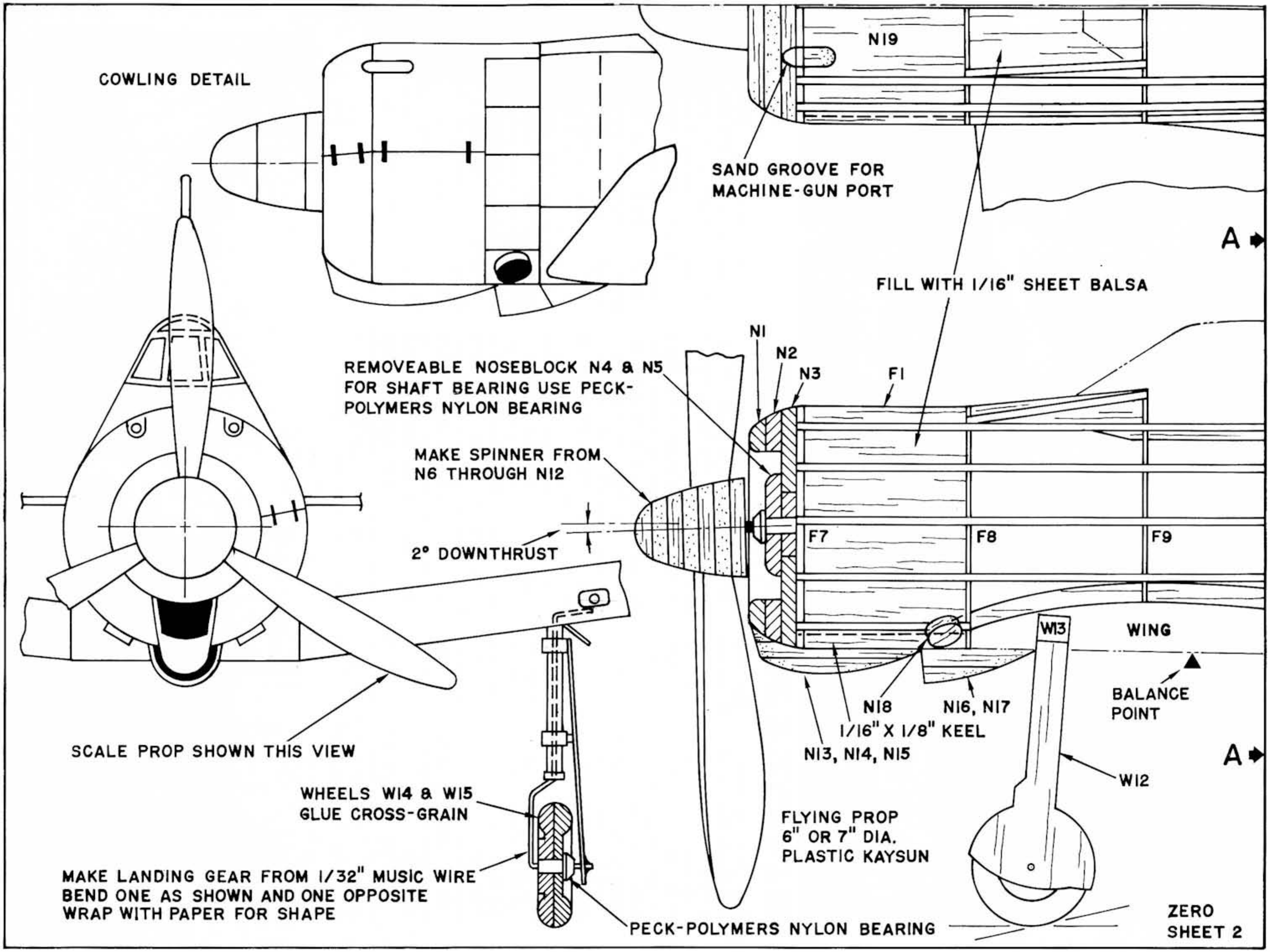
"Arco-Aircam Aviation Series No. 18 Mitsubishi A6M1/2/2N Zero-Sen" Arco Publishing Co., New York, N.Y.

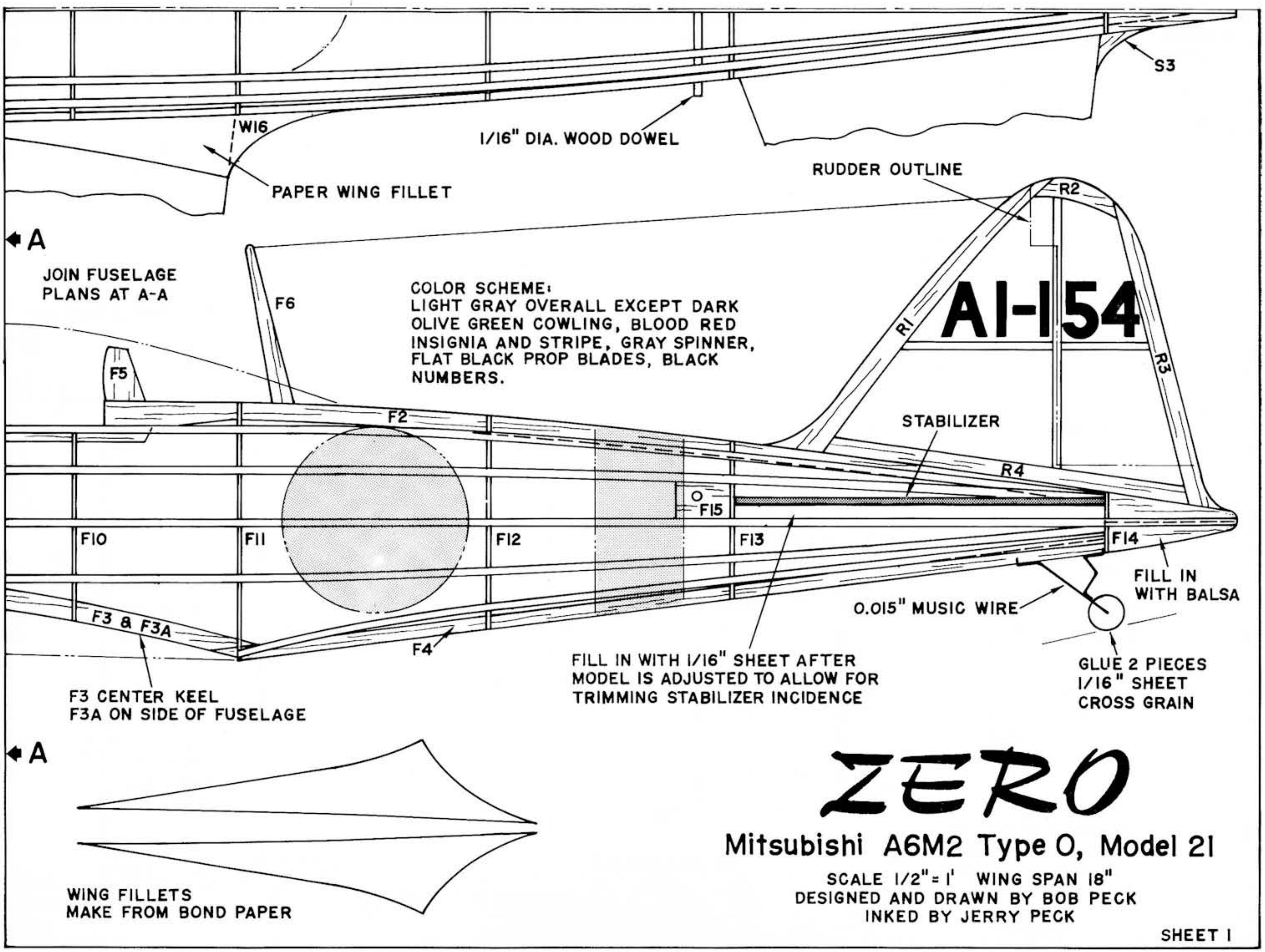
"Famous Fighters of the Second World War" by William Green. Published by Hanover House, Great Britain.



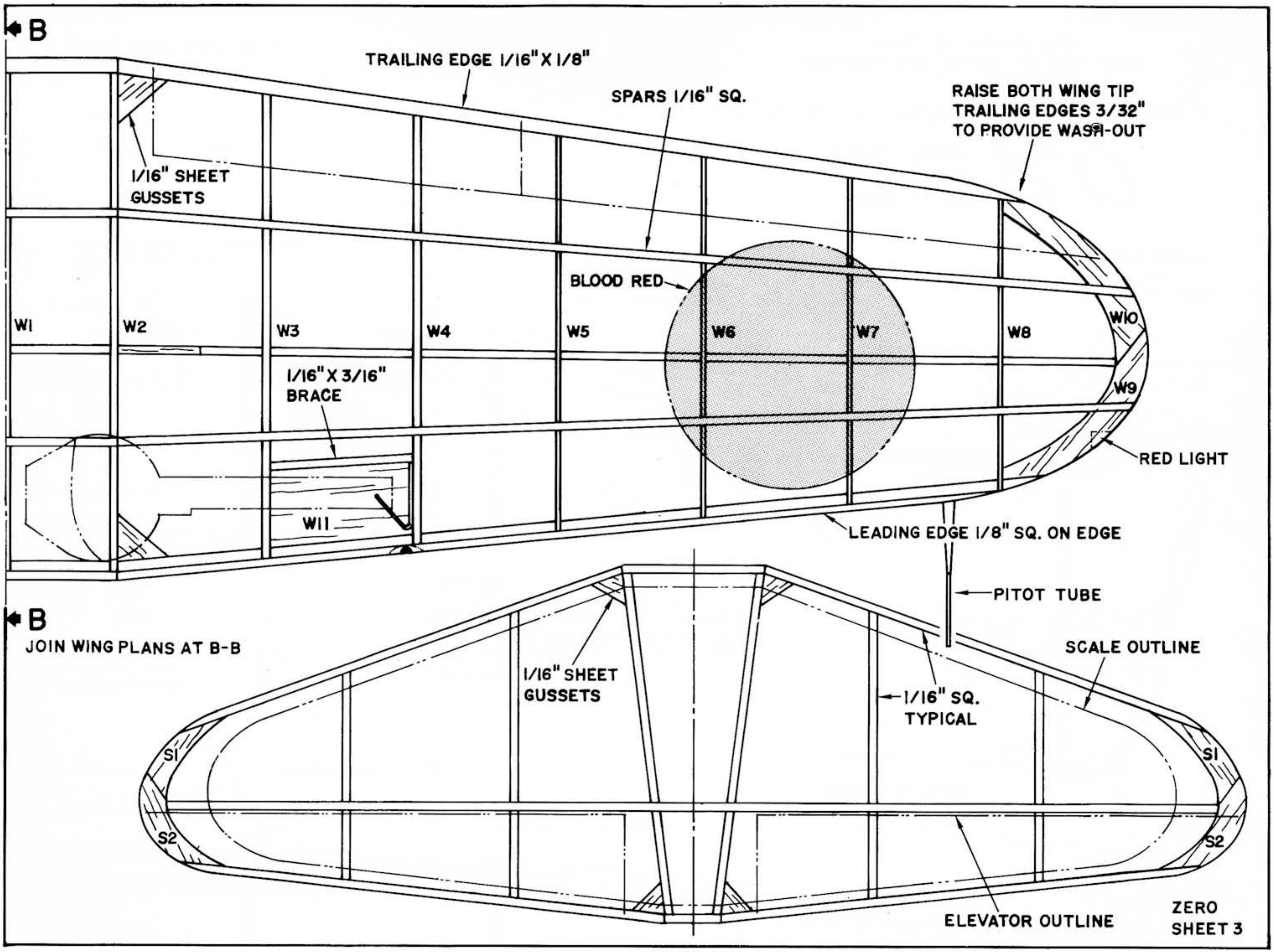



**The before and after of covering are shown in these two photos, both taken from the same angle. Bob prefers to use colored tissue in order to save weight.**

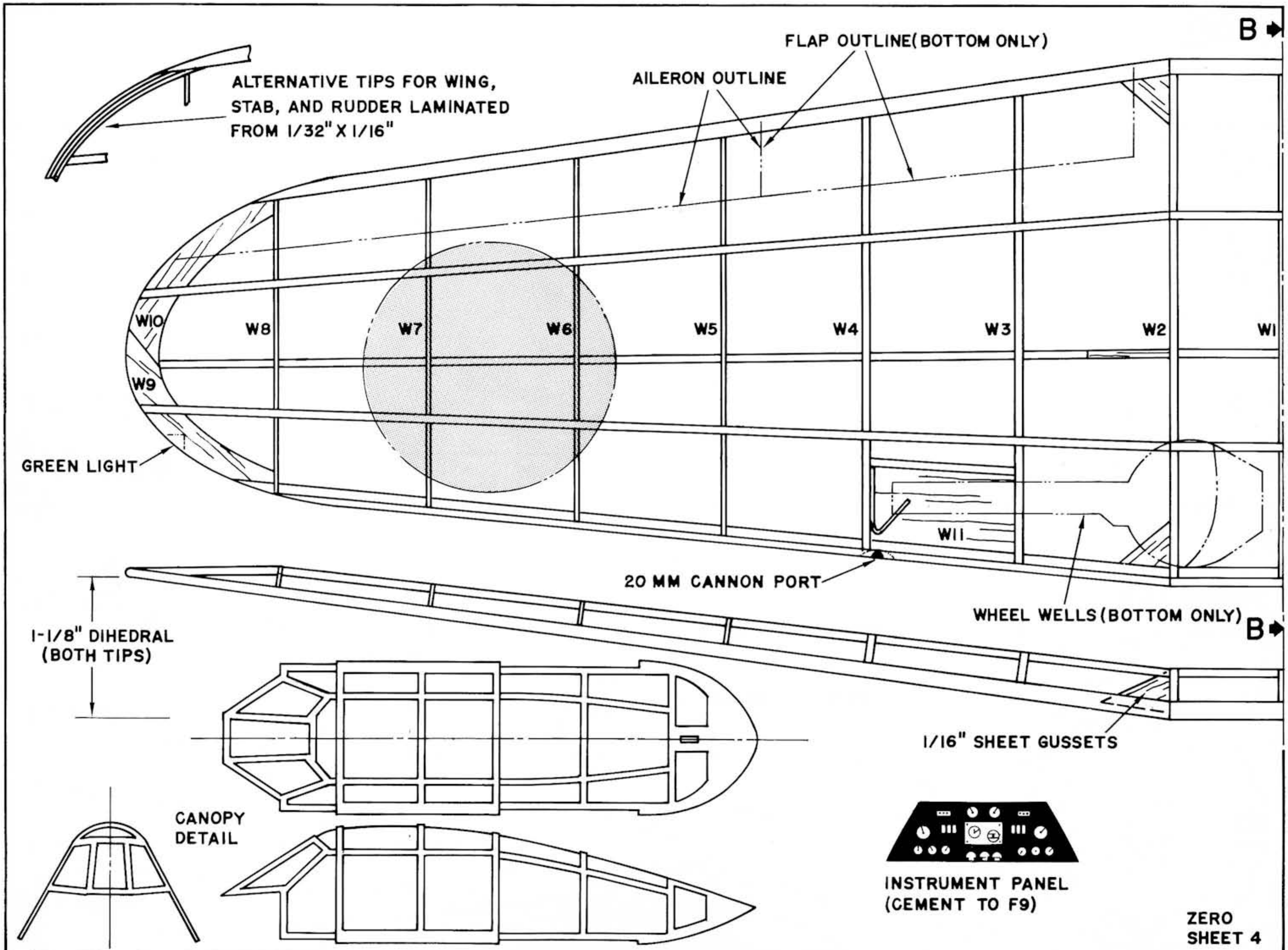

COWLING DETAIL
N19
SAND GROOVE FOR
MACHINE-GUN PORT
A
FILL WITH 1/16" SHEET BALSA
N1
N2
N3
F1
REMOVEABLE NOSEBLOCK N4 & N5
FOR SHAFT BEARING USE PECK-
POLYMERS NYLON BEARING
MAKE SPINNER FROM
N6 THROUGH N12
2° DOWNTHRUST
F7
F8
F9
W13
WING
BALANCE
POINT
N18
N16, N17
1/16" X 1/8" KEEL
N13, N14, N15
A
W12
SCALE PROP SHOWN THIS VIEW
WHEELS W14 & W15
GLUE CROSS-GRAIN
FLYING PROP
6" OR 7" DIA.
PLASTIC KAYSUN
MAKE LANDING GEAR FROM 1/32" MUSIC WIRE
BEND ONE AS SHOWN AND ONE OPPOSITE
WRAP WITH PAPER FOR SHAPE
PECK-POLYMERS NYLON BEARING
ZERO
SHEET 2

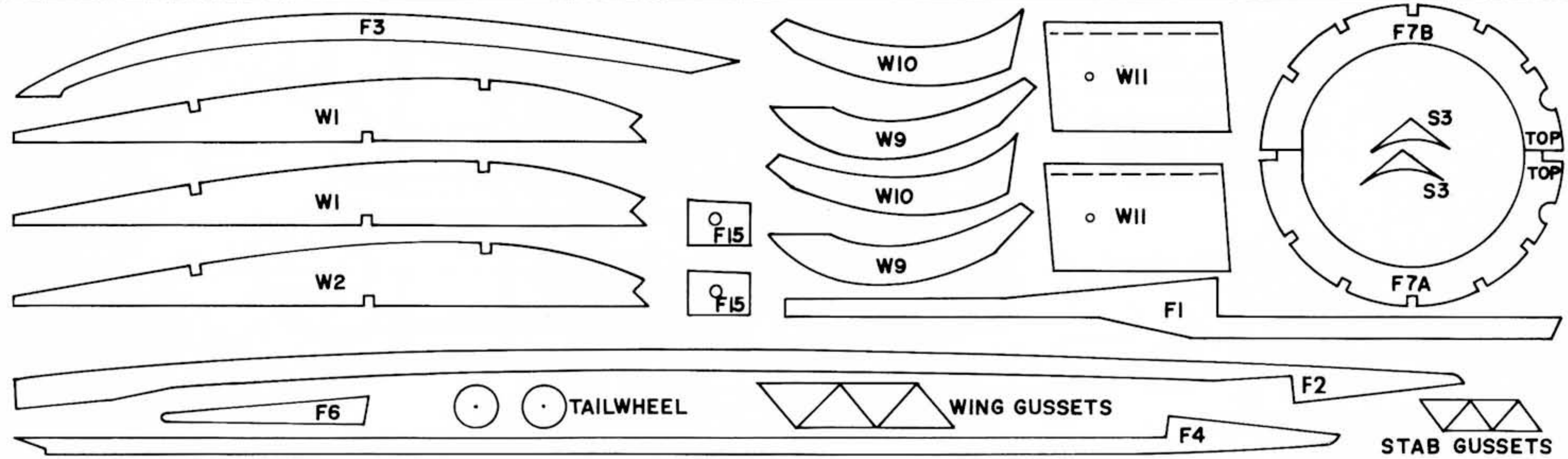

S3
W16
1/16" DIA. WOOD DOWEL
PAPER WING FILLET
RUDDER OUTLINE
R2
A
JOIN FUSELAGE
PLANS AT A-A
F6
COLOR SCHEME:
LIGHT GRAY OVERALL EXCEPT DARK
OLIVE GREEN COWLING, BLOOD RED
INSIGNIA AND STRIPE, GRAY SPINNER,
FLAT BLACK PROP BLADES, BLACK
NUMBERS.
R1
AI-154
R3
F5
F2
STABILIZER
R4
F15
F10
F11
F12
F13
F14
FILL IN
WITH BALSA
0.015" MUSIC WIRE
F3 & F3A
F4
FILL IN WITH 1/16" SHEET AFTER
MODEL IS ADJUSTED TO ALLOW FOR
TRIMMING STABILIZER INCIDENCE
GLUE 2 PIECES
1/16" SHEET
CROSS GRAIN
F3 CENTER KEEL
F3A ON SIDE OF FUSELAGE
A
ZERO
Mitsubishi A6M2 Type 0, Model 21
SCALE 1/2" = 1' WING SPAN 18"
DESIGNED AND DRAWN BY BOB PECK
INKED BY JERRY PECK
WING FILLETS
MAKE FROM BOND PAPER
SHEET 1

ZERO

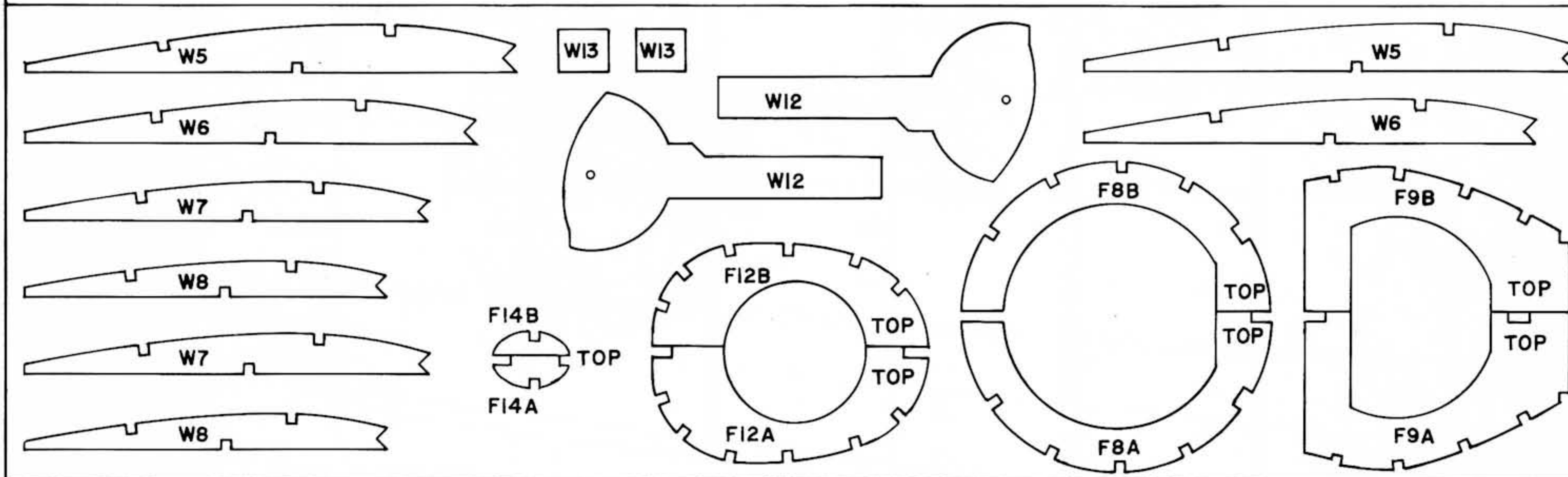


B
TRAILING EDGE 1/16" X 1/8"
SPARS 1/16" SQ.
RAISE BOTH WING TIP TRAILING EDGES 3/32" TO PROVIDE WASH-OUT
1/16" SHEET GUSSETS
BLOOD RED
W1
W2
W3
W4
W5
W6
W7
W8
W9
W10
W11
1/16" X 3/16" BRACE
RED LIGHT
LEADING EDGE 1/8" SQ. ON EDGE
PITOT TUBE
B
JOIN WING PLANS AT B-B
1/16" SHEET GUSSETS
1/16" SQ. TYPICAL
SCALE OUTLINE
S1
S2
S1
S2
ELEVATOR OUTLINE
ZERO SHEET 3


ALTERNATIVE TIPS FOR WING, STAB, AND RUDDER LAMINATED FROM 1/32" X 1/16"
FLAP OUTLINE (BOTTOM ONLY)
AILERON OUTLINE
B
W10
W9
W8
W7
W6
W5
W4
W3
W2
W1
W11
GREEN LIGHT
20 MM CANNON PORT
WHEEL WELLS (BOTTOM ONLY)
B
1-1/8" DIHEDRAL (BOTH TIPS)
1/16" SHEET GUSSETS
CANOPY DETAIL
INSTRUMENT PANEL (CEMENT TO F9)
ZERO SHEET 4

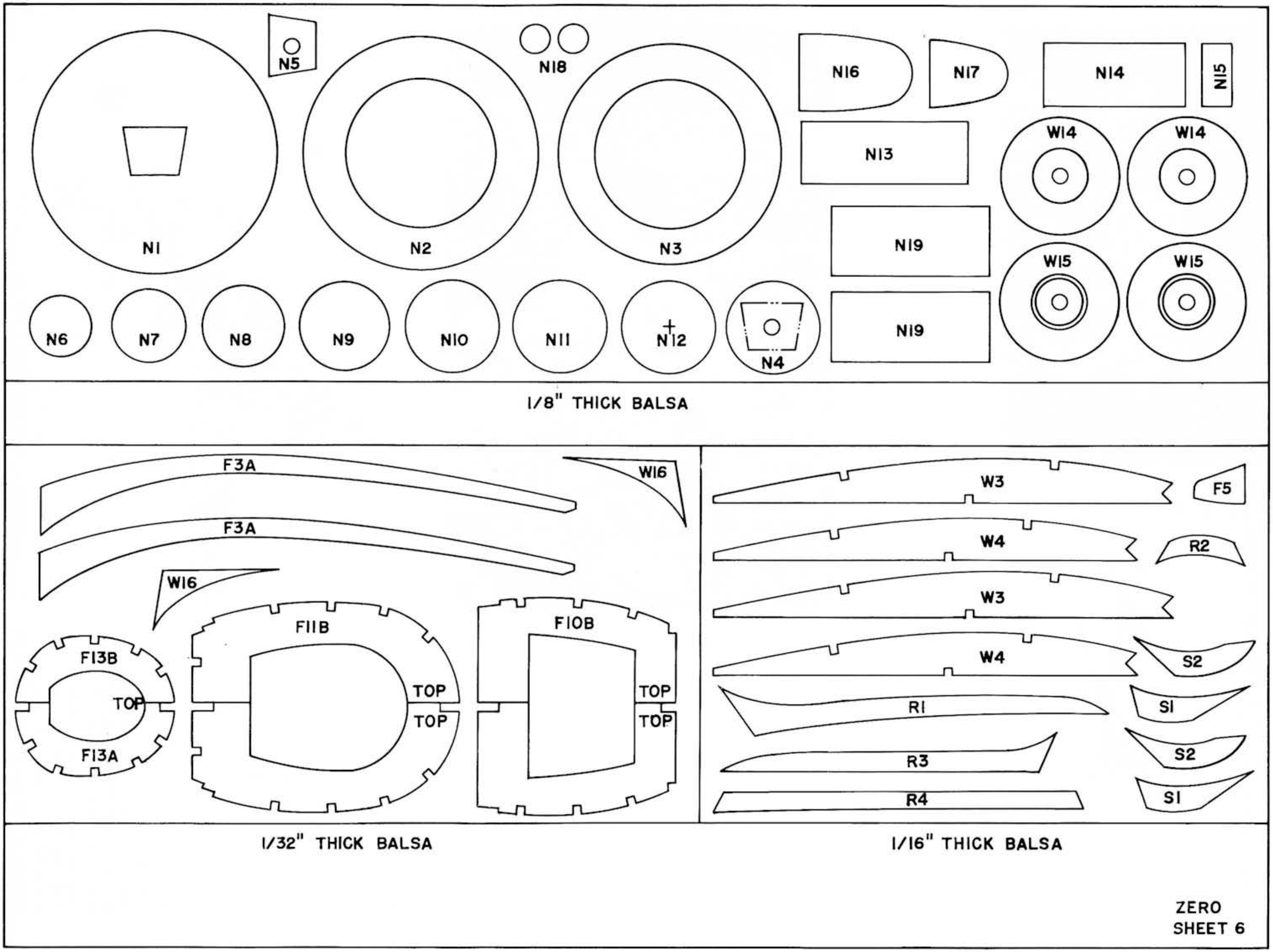



1/16" THICK BALSA

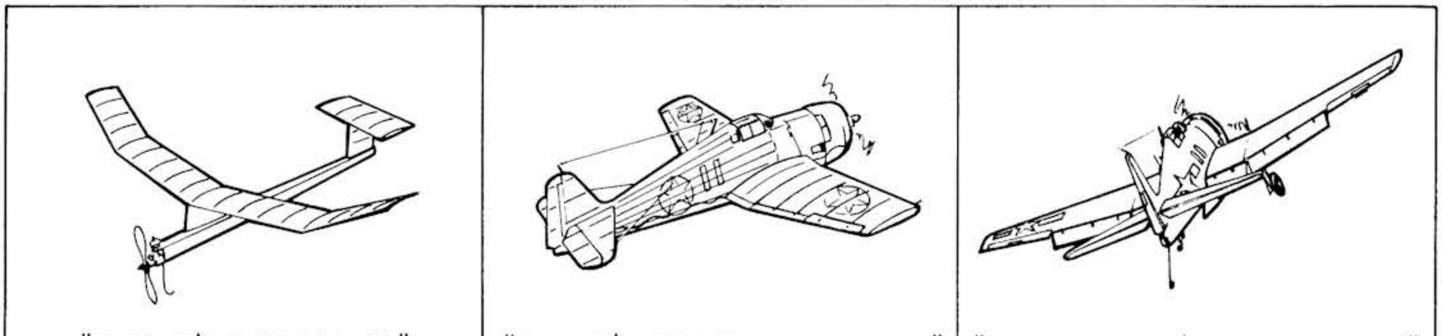



1/32" THICK BALSA

ZERO
SHEET 5


N5
N18
N16
N17
N14
N15
N13
W14
W14
N1
N2
N3
N19
W15
W15
N6
N7
N8
N9
N10
N11
N12
N4
N19
1/8" THICK BALSA
F3A
W16
W3
F5
F3A
W4
R2
W16
W3
F11B
F10B
F13B
W4
S2
TOP
TOP
TOP
TOP
TOP
R1
S1
F13A
R3
S2
R4
S1
1/32" THICK BALSA
1/16" THICK BALSA
ZERO
SHEET 6

SCALE ENTHUSIASTS ARE NEVER SATISFIED!



"BUT IT'S NOT SCALE!" "BUT IT'S TOO TRANSPARENT!" "BUT IT DOESN'T HAVE RIVETS!"

# Covering and Trimming

By BILL HANNAN

● There are several possible ways to finish a flying scale model. We are dealing in this case with free flight models, which are much more sensitive to weight variations than control-line or radio control types. In fact, weight constitutes one of the most important factors governing the performance in a free flight model, and thus one must apply the finish with a great deal of care and forethought.

A model may be suitably covered with tissue and balsa, then completely painted. The article by J. D. McHard, elsewhere in this volume, treats this approach. Another method involves the use of the relatively new plastic covering materials, such as Fascal, Monokote and Solarfilm. To date, their use has been confined primarily to non-scale models, but doubtless they will be employed more on scale models in the future as their advantages become more widely known, the price reduced, and more suitable thicknesses, colors, and finishes become available.

The third method is the time-honored traditional system of colored tissue finishing. This approach offers several advantages. First, as the covering is applied, so is the coloration, without additional effort or weight increase. Second, additional trim colors or markings are added using the same material, which eliminates the need for making, stencils, air brushes, and the like. Thus, the risk of "goofing" is greatly reduced.

As with most things in life, there are also a few disadvantages! To some people, a tissue colored model simply does not appear realistic. With the exception of very early aircraft of the pioneer era, very few full size machines have been translucent. Therefore, a model of say, an all-metal aircraft, which has light shining through it illuminating the internal structure, is just not acceptable to some. Of course. one might raise the argument that even an opaquely painted model severely misses the mark in terms of genuine "scaleness" in many respects.

The author regards a translucent scale model aircraft as a separate art form, which can stand on its own merits. The visual lightness of the finished model suggests the physical lightness of the machine. A comparison might be made with sculpture . . . picture a marble statue and one made of bronze. Neither correctly depicts actual human coloration, and yet each can be charming and effective in its own way.

Actually, most translucent models also employ a certain amount of paint, and a combination of methods are often used, gaining advantage from each.

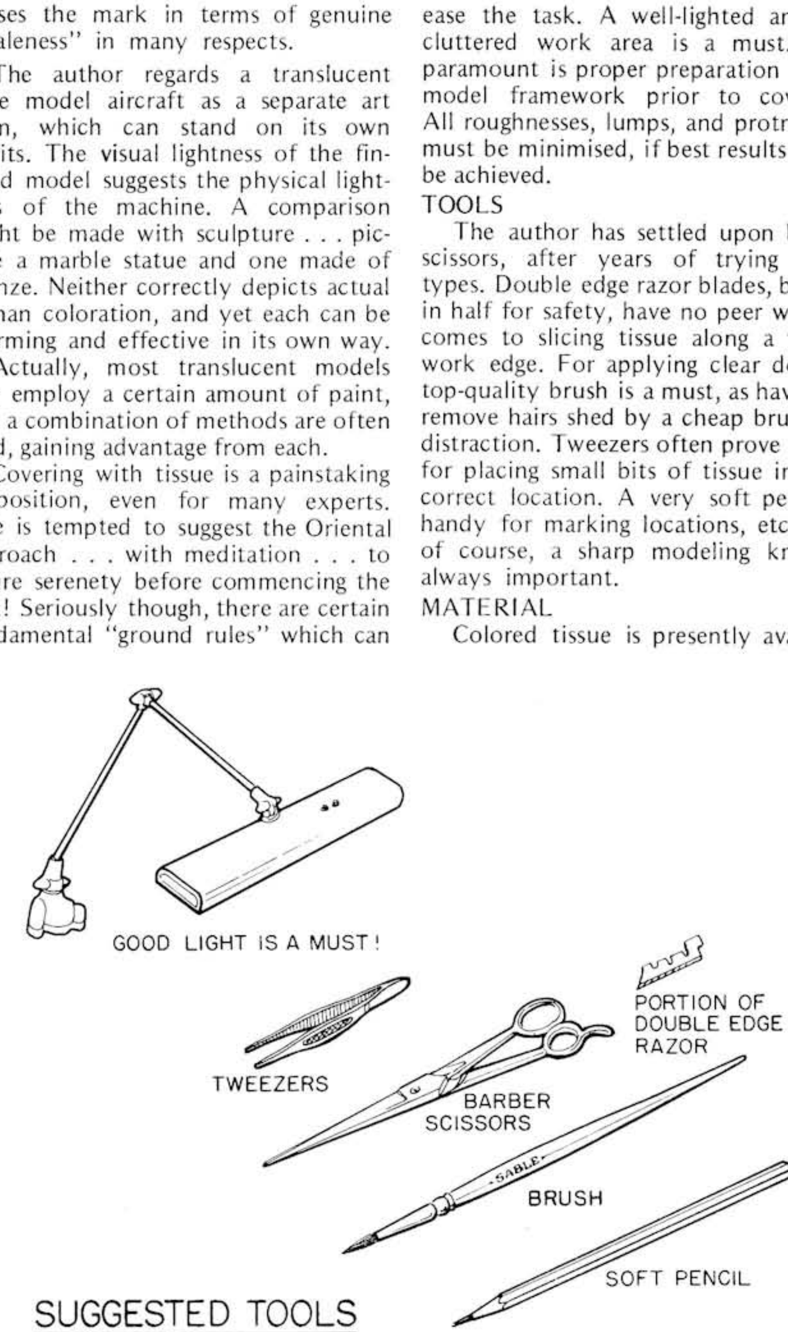
Covering with tissue is a painstaking proposition, even for many experts. One is tempted to suggest the Oriental approach . . . with meditation . . . to assure serenety before commencing the task! Seriously though, there are certain fundamental "ground rules" which can ease the task. A well-lighted and uncluttered work area is a must. Also paramount is proper preparation of the model framework prior to covering. All roughnesses, lumps, and protrusions must be minimised, if best results are to be achieved.

TOOLS

The author has settled upon barber scissors, after years of trying other types. Double edge razor blades, broken in half for safety, have no peer when it comes to slicing tissue along a framework edge. For applying clear dope, a top-quality brush is a must, as having to remove hairs shed by a cheap brush is a distraction. Tweezers often prove handy for placing small bits of tissue in their correct location. A very soft pencil is handy for marking locations, etc., and of course, a sharp modeling knife is always important.

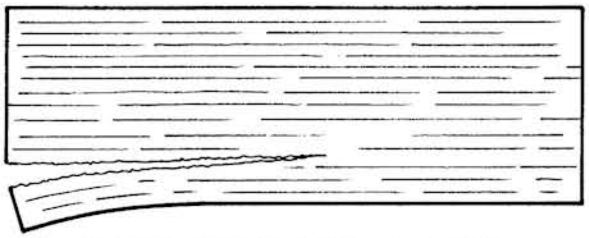
MATERIAL

Colored tissue is presently available

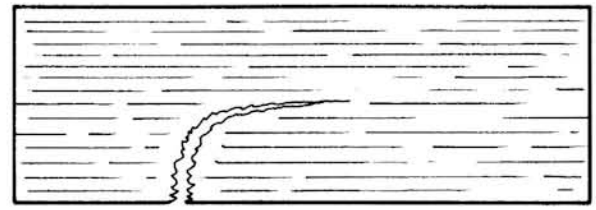



SUGGESTED TOOLS

## TO FIND DIRECTION OF GRAIN IN JAPANESE TISSUE



TEAR WITH THE GRAIN



TEAR AGAINST THE GRAIN

in a tremendous variety. The traditional "Japanese tissue," while sometimes difficult to find, is still on the market in various grades. Perhaps the most frustrating aspect of the material, is the bewildering array of forms it takes. One man's "superfine" is the next man's sheet iron. We can only suggest direct comparison of samples. The cost is so low that it behooves one to buy at least a few sheets of every type encountered. Unfortunately, Japanese tissue is generally available in only limited range of colors, some of which are more suited to sport models than scale types. Locally, red, yellow, blue, orange, and black constitute virtually the entire spectrum of colors being sold; every now and then some green will turn up, and occasionally rumors of prewar type silver, which usually turns out to be merely pale grey.

Certain domestic tissues are also on the market, which can be employed for model covering. Although several brands are involved, there seem to be basic similarities. Most Japanese tissue has a pronounced grain, which can be easily detected by tearing a section. Domestic tissue is often grainless, and can be torn in any direction. A second distinguishing characteristic; some domestic colored tissues are not colorfast. This means that when the covering is shrunk, the water must be applied in a fine mist to avoid droplets which could cause unsightly streaking of the color. Thicknesses and weights vary greatly, along with porosity and shrinking properties.

ADHESIVES

The most commonly used adhesive for tissue covering seems to be clear dope, but some prefer the use of thinned white glue or aliphatic resins, such as "Titebond." Still others mix a small amount of model cement with clear dope. Each system has its points. The use of white glue permits direct application of the tissue without further preparation of the frame, whereas the use of dope typically involves application of several coats to provide a proper base. Owing to the moisture contained in water-base glues, the wood warping may be increased. The clear dope, if suitably plasticized, should help prevent wood warping caused by moisture.

OTHER MATERIALS

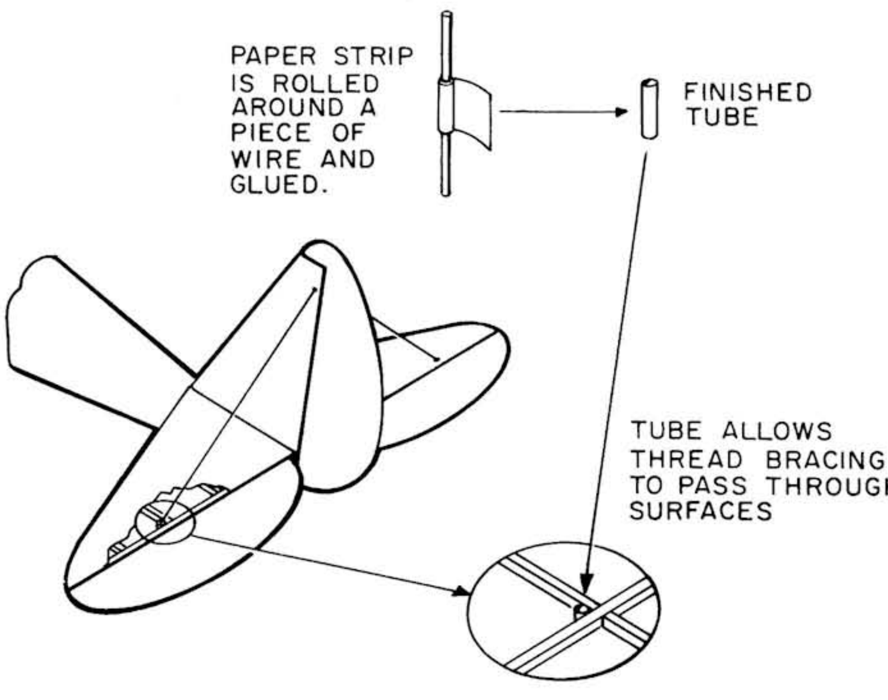
Often in small models, certain sections, such as cowlings, are covered with paper other than tissue. On plans, this is usually called out as bond or typing paper, and that is O.K., if the paper is to be subsequently covered with tissue for color. Sometimes, however, it is desireable to paint the paper. In that case, the use of coated stock is suggested. Coated stock is the type of paper which is shiny, such as used for magazine covers. This type of stock can be obtained in various thicknesses, and almost any printer will have samples. Perhaps he will give you a sheet or two for the asking, or certainly at very low cost. One or two thin coats of paint on this material will provide a finish superior to several coats on ordinary bond paper. The same remarks apply to card stock, which is often useful for small detail parts such as landing gear doors. Card stock will bend, rather than break as balsa would, under similar loads.

Another useful material for finishing certain parts of models is pre-printed paper. For example, the instrument panels on some full-size aircraft are made of decorative wood. This can be effectively simulated with contact paper featuring a wood-grain pattern, or even with printed color photos of wood.

Weight must be considered during the choosing of all materials. Sometimes, for reasons of strength, celluloid must be employed for windshields. This is not generally true of cabin windows, however, so cellophane may be used instead, with a worth-while weight savings.

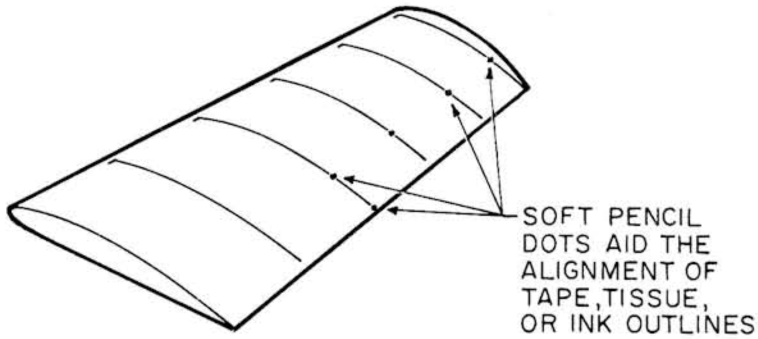
RIGGING

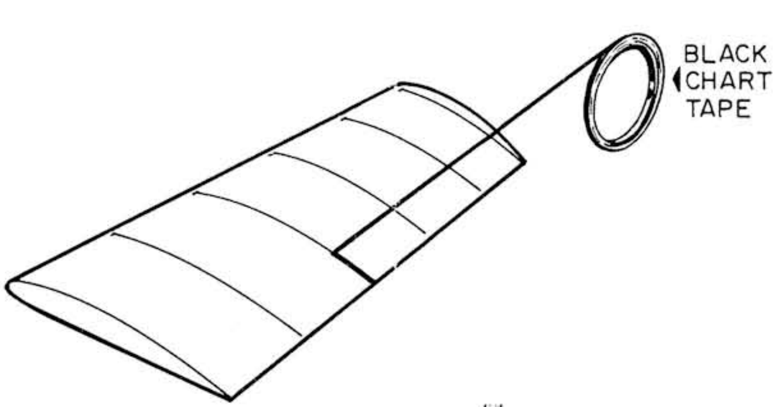
If the model features external control wires, antennas or wire bracing, these items should be given consideration before covering is applied. Often, tiny rolled paper tubes can be attached to the structure, permitting the rigging to pass completely through the member. It may then be tied with a single knot at the least conspicuous possible location.

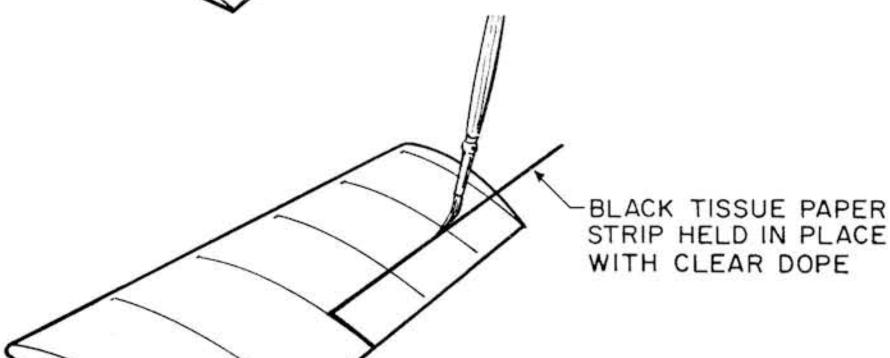


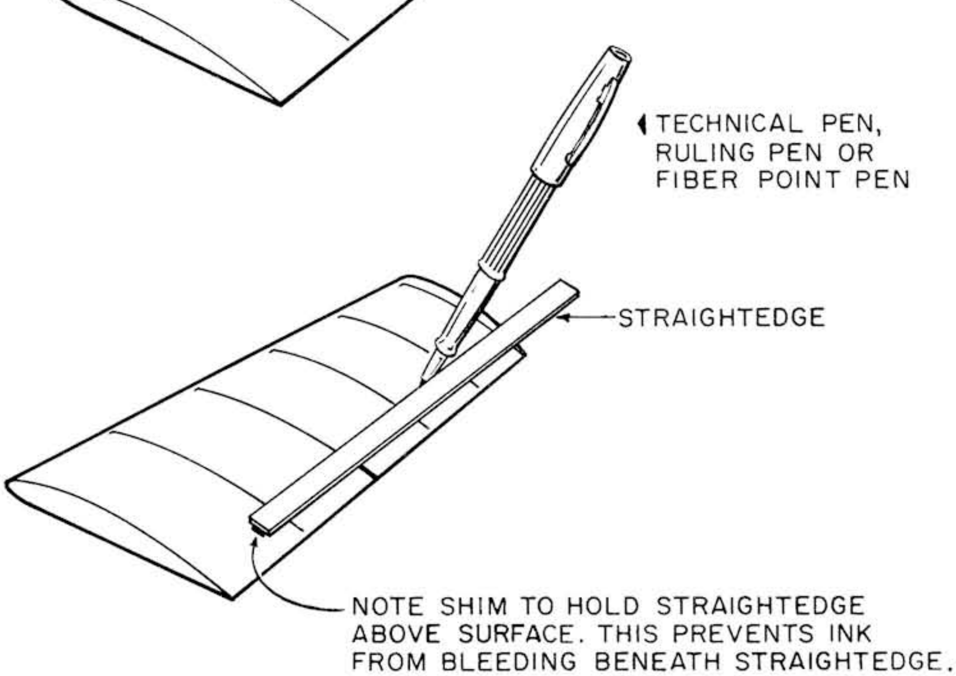

## PROVISIONS FOR RIGGING

# CONTROL SURFACE OUTLINES




Since the rigging is all one piece, as in our illustrated example, the knot can be placed completely out of sight, if desired, by making the tie adjacent to a tube, then carefully working the knot inside the tube by sliding the rigging. A drop of glue applied to each point where rigging enters a tube will add strength to the structure. In the case of antennas or control wires which disappear into the model, a tiny glue-coated sliver of balsa can be inserted in the paper tube to lock the wire in position. Thread is generally employed on flying models in lieu of wire, to reduce weight. Silk thread is best for this purpose, since It is not fuzzy as are most common threads. Another suitable material is nylon monofilament, such as is used for fishing lines. It is available in many diameters, and may be shrunk with the application of heat to tighten the rigging. Silk thread may be tightened by water shrinking.

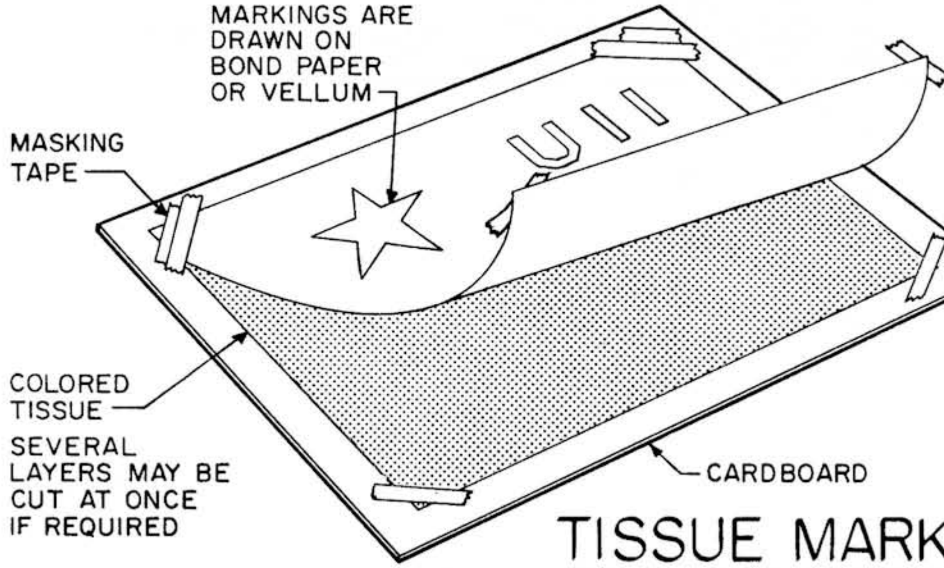
## TECHNIQUE

Assuming the tissue is to be applied by the clear dope method, give the framework an overall sanding with No. 400 wet-or-dry and apply two coats of clear. The framework is then resanded to eliminate balsa fuzz raised by the doping, and two more coats of clear are applied. Prepare a section of tissue for application by cutting it slightly larger than the area to be covered. Don't attempt to cover too much at a time, but rather, use smaller sections, particularly where curves are involved, as for example on wing tips. Place the tissue over the panel to be covered, and flow dope thinner THROUGH the tissue from the top, which softens the clear dope underneath enough to render it sticky. Work the tissue into place smoothly. It need not be tight at this stage, as shrinking will see to that later, but do try to avoid wrinkles. In the event of a goof, additional applications of thinner will enable the tissue to be lifted and replaced. Be careful not to get dope on the tissue beyond the framework, as it may cause wrinkles when the covering is shrunk.

Occasionally, a little extra clear dope will need to be applied to secure edges, overlaps, etc. Also, a little water on a fingertip can sometimes tame edges which have a tendency to pop up. (Bear in mind, however, the earlier mention of certain tissues that are not colorfast). Balsa wood areas, such as cowlings, can also be covered with tissue, and left as is or painted, in which case the tissue will serve as a primer for paint.

## SHRINKING

This seemingly simple subject can be a source of frustration to the unwary. As mentioned earlier, certain tissues have pronounced grain characteristics which can cause unequal shrinkage, leading to warpage, wrinkles or both.




# TISSUE MARKINGS

Most authorities suggest application of the grain parallel with the length of the surface, but others disagree, and it seems a matter of experimentation for each builder. In any event, delicate surfaces should be pinned to the work during the shrinking operation, if possible. Sometimes a simple balsa jig can be made to hold the part off the work board, so that both sides may be shrunk at once.

Water for shrinking may be applied with a piece of cotton, an atomizer, or in the form of steam. Again, the lack of color-fastness may help determine the choice. Another approach, which seems to have originated in France, involves the use of alcohol for shrinking. Alcohol has an affinity for water of course, and the fact that it is in solution seems to produce a milder shrinking action, which may be safer for delicate structures.

SURFACE DECOR

Here is where an average model may be transformed into a real showpiece. Markings can add sparkle and visual interest to a model, weigh very little, and are well worth the time required to apply. While a really "serious" scale model will feature separate ailerons, rudder, elevators, etc., the average model usually has these components constructed integral with the main surfaces. By outlining these controls, an effective simulation can be achieved with much less effort than building the parts separately. Perhaps the simplest approach involves the use of chart tapes, which may be obtained in art supply stores. This tape is available in many colors, and in various widths which can also be used for striping.

For control surface definition, dull finish tape is far more effective than the shiny variety. When applying it to the model, make every effort to keep the lines straight. Making tiny dots with a soft pencil at each end may help. Avoid stretching the tape, as it might later contract, causing wrinkles in the covering. The disadvantage of tape is that it is fairly thick, and its sticky edges sometimes attract dust and hairs.

Another approach to surface delineation involves the use of ink. The time-honored system requires the use of a drafting pen and india ink. This is easier said than done, however. Some of the newer technical drawing pens aid the task as compared to the almost diabolical ruling pens, but care is still required to do a neat, convincing job. If the ink shows a tendency to "crawl", the surface can be cleaned using an artist's kneaded eraser. If the line is drawn too slowly, it may "bleed" to an unwanted width. Use a straight edge, which may be shimmed slightly off the surface to prevent ink running under and smearing.

Fine-tip fiber point pens may also be used for the task. With either type of ink, it is a good plan to apply a clear coating to protect the lines from moisture and handling. Caution . . . some types of ink can be dissolved by clear dope. Test first! Or, use a clear enamel such as sold for use on plastic models. A light coat applied from a spray can is usually sufficient.

The third method requires thin strips of black tissue to define the surface outlines. Give the covering of the model a coat or two of thin clear dope. Next, apply a coat of clear to a sheet of black tissue. It may be necessary to tape the tissue to a picture frame to prevent it from curling while the clear dope dries. Tape the dried sheet of tissue to a sheet of cardboard to hold it taut. Using a very sharp blade and a straight edge, slice thin strips from the tissue. With practice, these can be as little as 1/64 inch wide, and as long as required. On larger models, 1/32 inch may be a more appropriate width. Place the tissue strip in the desired position on the model, and apply thinner to secure it in place. A final very thin coat of clear dope over the top will lock it in position.

MARKINGS

Insignia or other markings can also be applied by the tissue method. Prepare the tissue with a coat of clear dope and tape to a sheet of cardboard, as described before. If two or more markings of the same kind are needed, add more layers of tissue, as required, so all may be cut in a single operation. Place a paper with the marking drawn on it directly over the colored tissue and tape in place. With a very sharp blade, cut through the pattern, tissue, and slightly into the cardboard. This will insure clean, concise cuts.

Sometimes a letter or other marking will line up with a wing rib or spar, and can be simply "eyeballed" into position, while thinner is flowed through to adhere it to the model. In other cases, it is well to make a simple locating guide so that the tissue marking can be positioned through the cut out space in the pattern for exact location. Or, guide lines may be drawn on with a VERY soft pencil, later to be removed with a kneaded eraser.

Decals are not usually suitable for translucent models, tending to upset the "stained glass window" effect. However, there are cases in which some sort of opaque markings should be employed. For example, if a model is covered with a dark colored tissue and its markings are to be white, the base color would show through, giving the markings a muddy appearance. In this case, the white decorations can be cut from an opaque paper.

Perhaps the most vital ingredients involved in achieving a first rate finishing job are time and patience. Top results can simply not be obtained under rushed conditions. A flying scale model builder should be prepared to spend the time and effort required to properly finish his model. The compliments of fellow modelers, as well as extra points from contest judges, will be your reward. ●

**The author's model of the 1940 Hurricane as flown by Pilot Officer Pniak, No. 257 Sqdn., based at North Weald, in Essex.**

# HAWKER HURRICANE I

**By J. D. McHARD**

● The Hurricane marked the birth of the multi-gun monoplane fighter and the death of the biplane in the R.A.F.

Designed to Air Ministry specification F36/34, and first flying on 6th November, 1935, it was of steel tube and fabric construction unlike its contemporary, the Supermarine Spitfire, which was of stressed skin construction.

The newly produced Rolls Royce Merlin engine of 1,000 hp. was a vital part of the design mix of both the Hurricane and the Spitfire, but it was not without its early teething troubles and these occasionally placed the whole project in jeopardy.

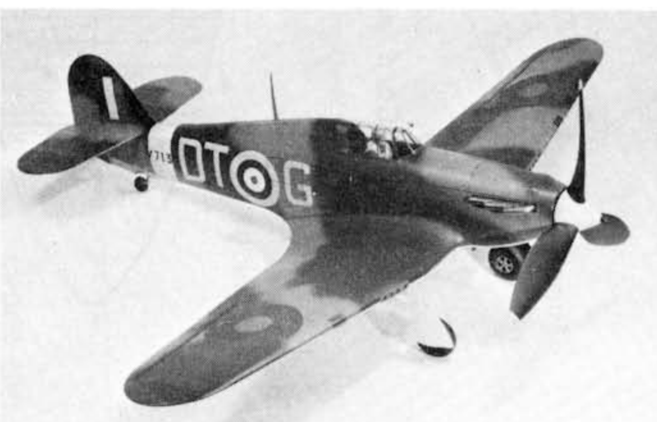
Good fortune, hard work and dogged confidence on the part of Hawker saw the Hurricane through the critcal first year, but it was not until June, 1936 that an Air Ministry contract for 600 machines was awarded.

Eighteen months later, No. 111 Sqdn. received the first production Hurricanes, and in February, 1938, their Commanding Officer, Squadron Leader John Gillan, with a sharp eye for public relations and making use of a fine tailwind, set up a new Edinburg to London record, a distance of 327 miles, at an average ground speed of 408.78 mph! (The Hurricane's top air speed was a little over 320 mph).

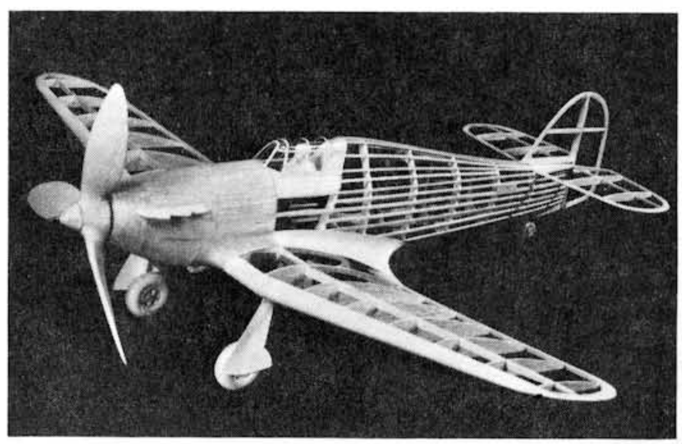
The Hurricane was exported to several countries, including Belgium, Yugoslavia, Eire, Rumania and Finland but, of course, it was during the Battle of Britain in 1940 that its imortality was assured.

Its rugged, easily repaired structure was capable of absorbing an enormous amount of battle damage; and although perhaps the more elegant and higher performance Spitfire is now regarded as symbolising that epic period, the Hurricane bore the brunt of the fight during the first two years of the war.

Hurricanes were also built in Canada, the first of these flying in January, 1940. They served in all the major theaters of war from the Far East, 'round the world

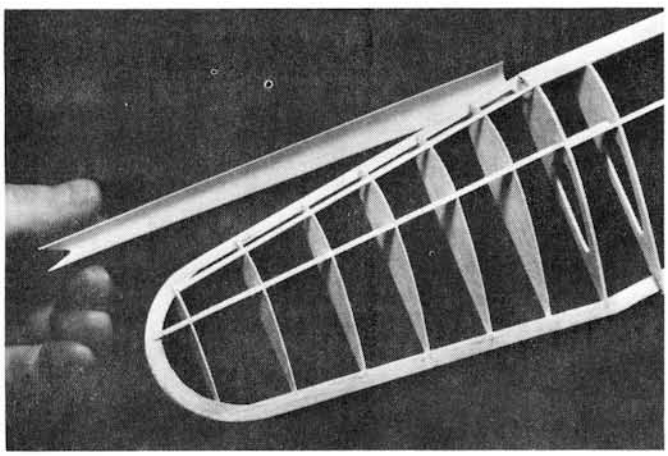


**Doug McHard's methods of covering, finishing, and detailing are well described in his photo/article beginning on page 118.**

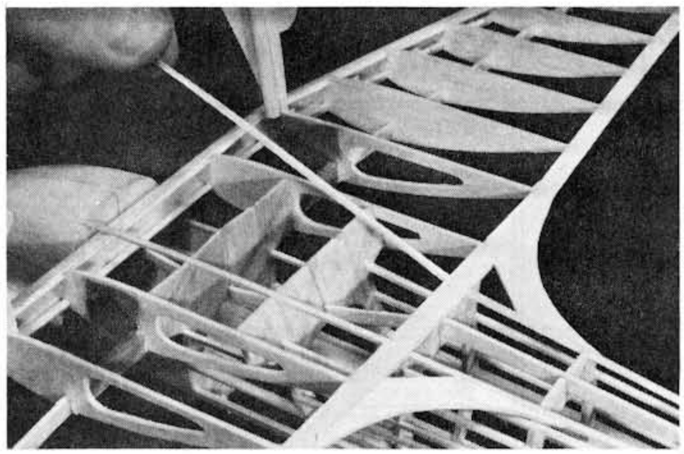


**Doug has used more stringers than necessary on a model of this size in order to capture this outstanding characteristic of the Hurricane.**

**The propeller is really the only giveaway in this photo that the plane is not real, and points up the advantage of having the prop in motion when taking such a picture, as at the top of page 47.**



**Leading edge sheet may be stiff paper or 1/64 balsa. Sheet is formed to shape before glueing to framework.**



**After wing is in place, remaining stringers are added. Landing gear is held in place by epoxy-saturated silk patches.**

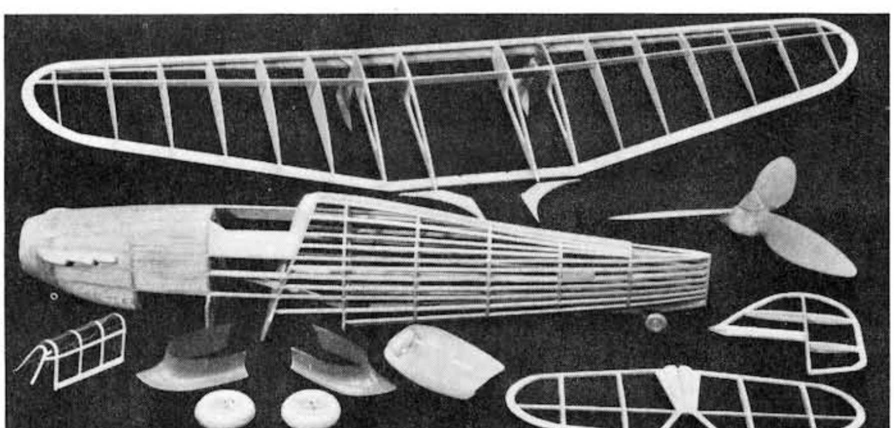
to the U.S.S.R.

Our model is based upon a machine belonging to No. 257 Sqdn., based at North Weald in Essex in 1940, and generally flown by Pilot Officer Pniak.

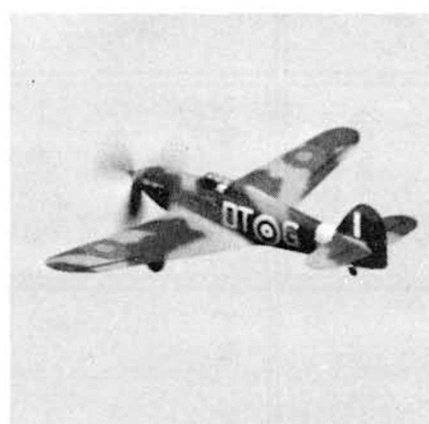
An attempt has been made with this model to reproduce the bluff, rounded, multi-stringered appearance so characteristic of the Hurricane, but so rarely captured in miniature.

CONSTRUCTION

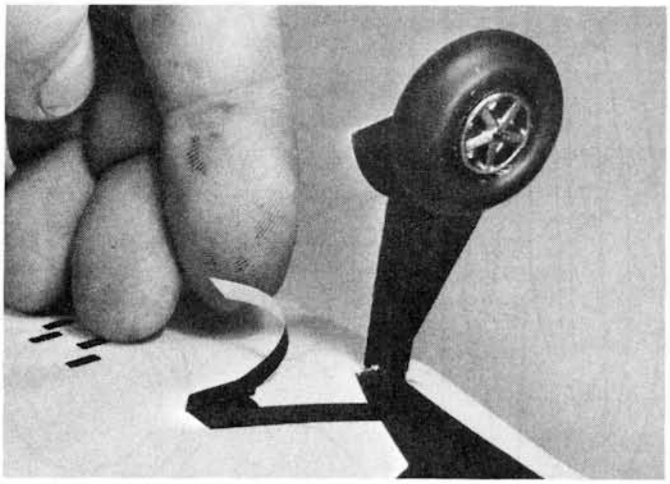
In models of this kind, it is, of course, impossible to reproduce accurately every external feature of the original machine. Ribs will invariably protrude on the wing and tailplane, wheel wells will be painted on, and propellers will most likely be oversize.



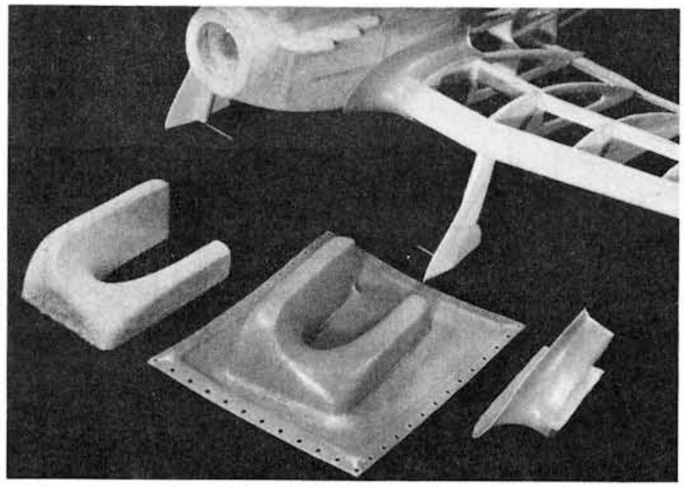
**The Hurricane framework before assembly. Note also the extensive use of molded plastic parts.**



**The Hurricane takes off on a sortie. Model flies well on rubber, could also use $CO_2$.**



Dummy strut fairing is glued to wing only, and is not subjected to landing shocks. Wheel construction is detailed on page 124.



Mattel Vac-U-Form is handy for small molded parts . . . if you can find one. They are no longer being made, but many are around.

The difference between an "average" model and a really good one frequently lies in the designer's ability to recognize the most important characteristics of the prototype and to reproduce them as closely as possible. If these key features are right, the rest of the model can often be simplified to its constructional and flying advantage.

It is my opinion that the Hurricane's personality has rarely been captured in small model form, and one reason for this is the difficulty of simulating the extra thick wing with its very blunt leading edge. Reduce this radius and you lose the Hurricane.

The rear fuselage really *needs* all those stringers to achieve a convincing effect, and the wing root leading edge fairing is another elusive point of reference.

The photographs illustrate my own attempt to overcome the difficulties presented by these constructional problems. Basically, however, the construction follows conventional lines, and with care, should not present any undue difficulties.

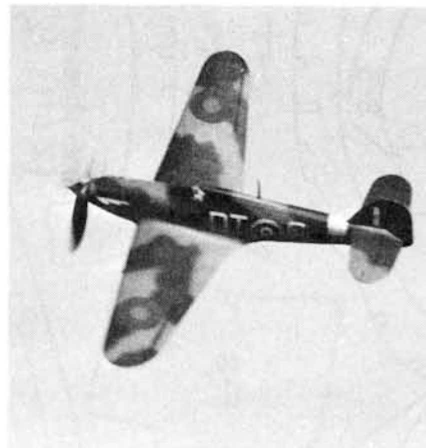
REFERENCES


Profile Publications No. 111 "The Hawker Hurricane I.

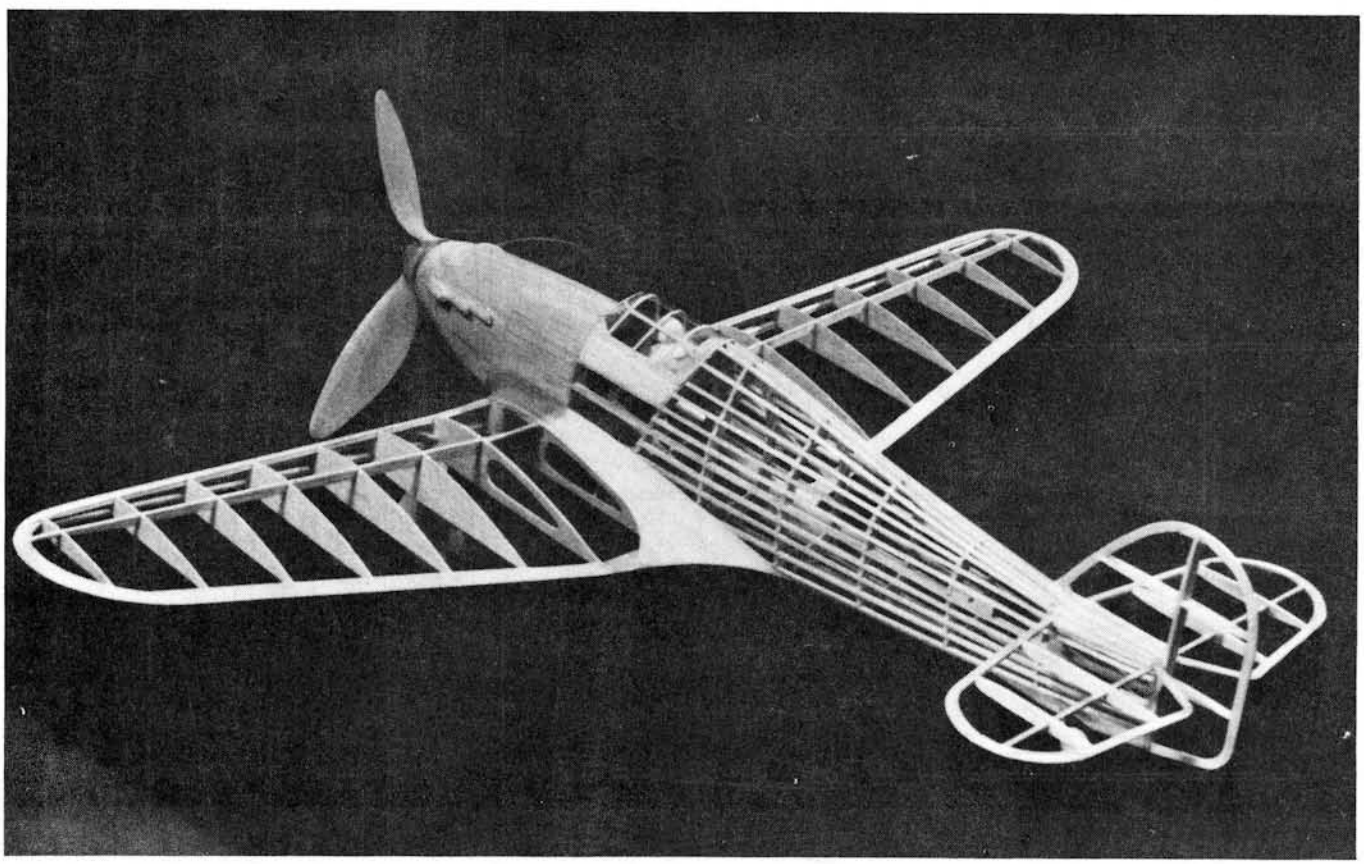
MacDonald Aircraft Monograph "The Hawker Hurricane.

Aeromodeller Magazine – Plan & Feature.

Airfix 1/24th Scale Plastic Model. ●

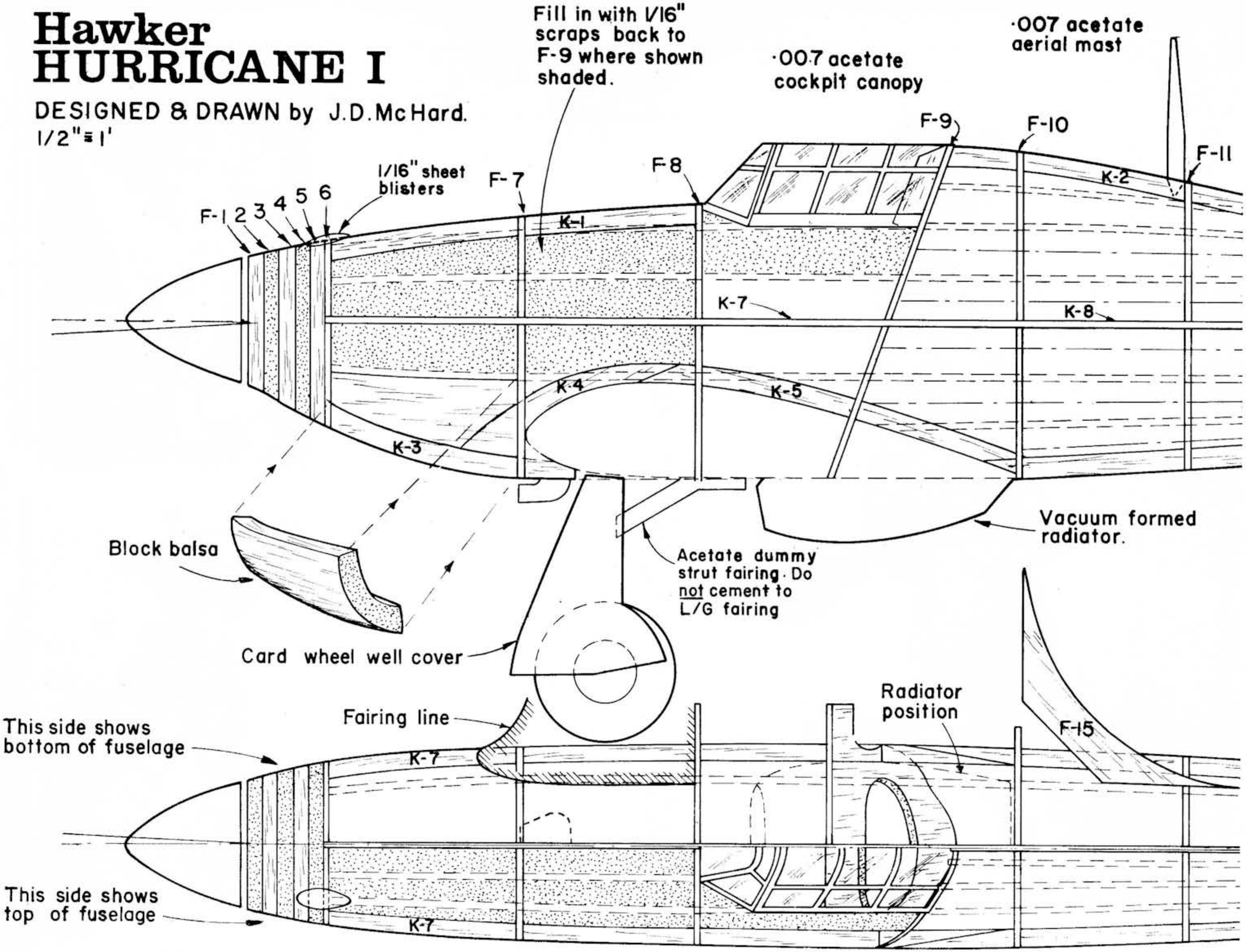



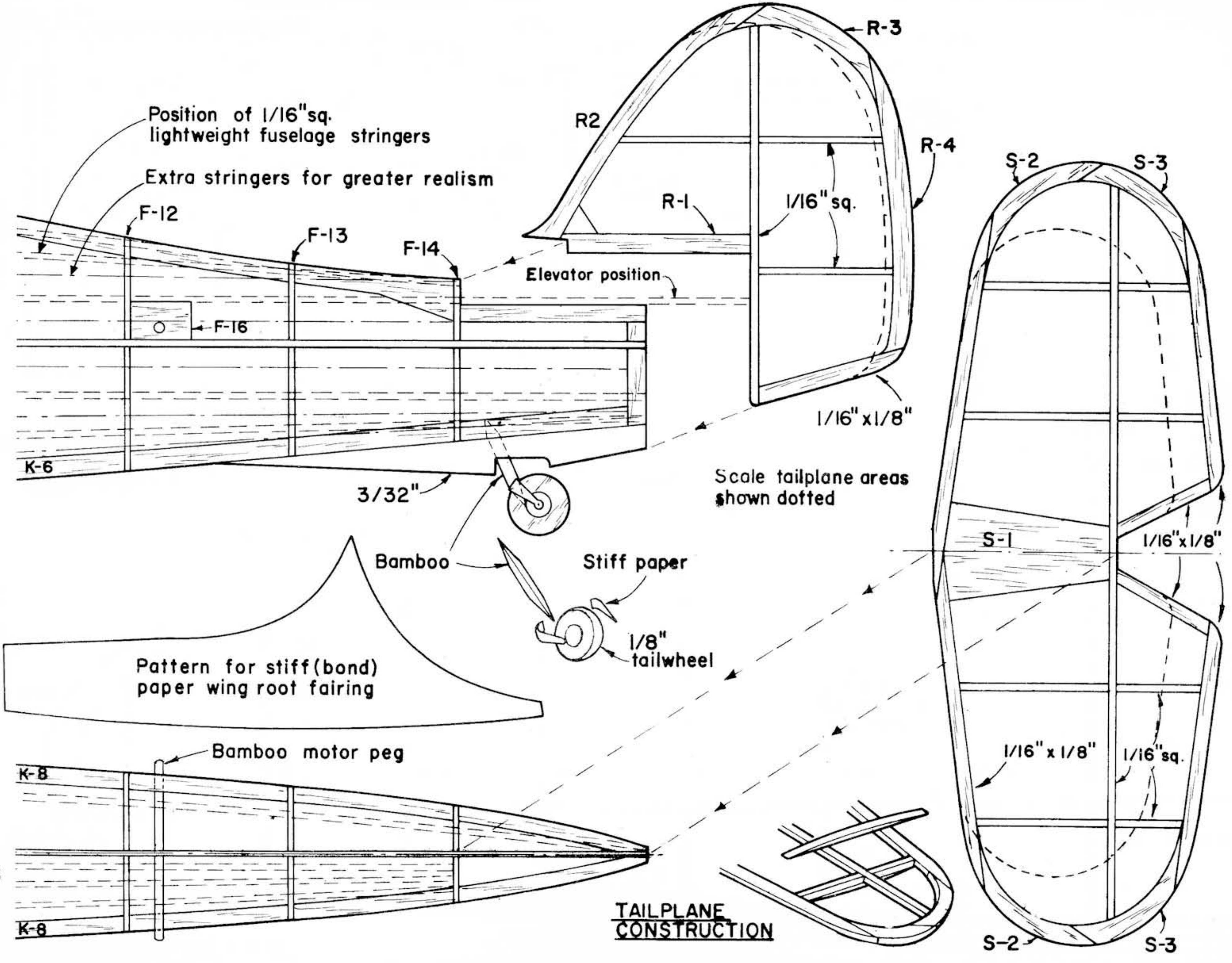
Doug's Hurricane banks to the left as it climbs out under the initial power burst.

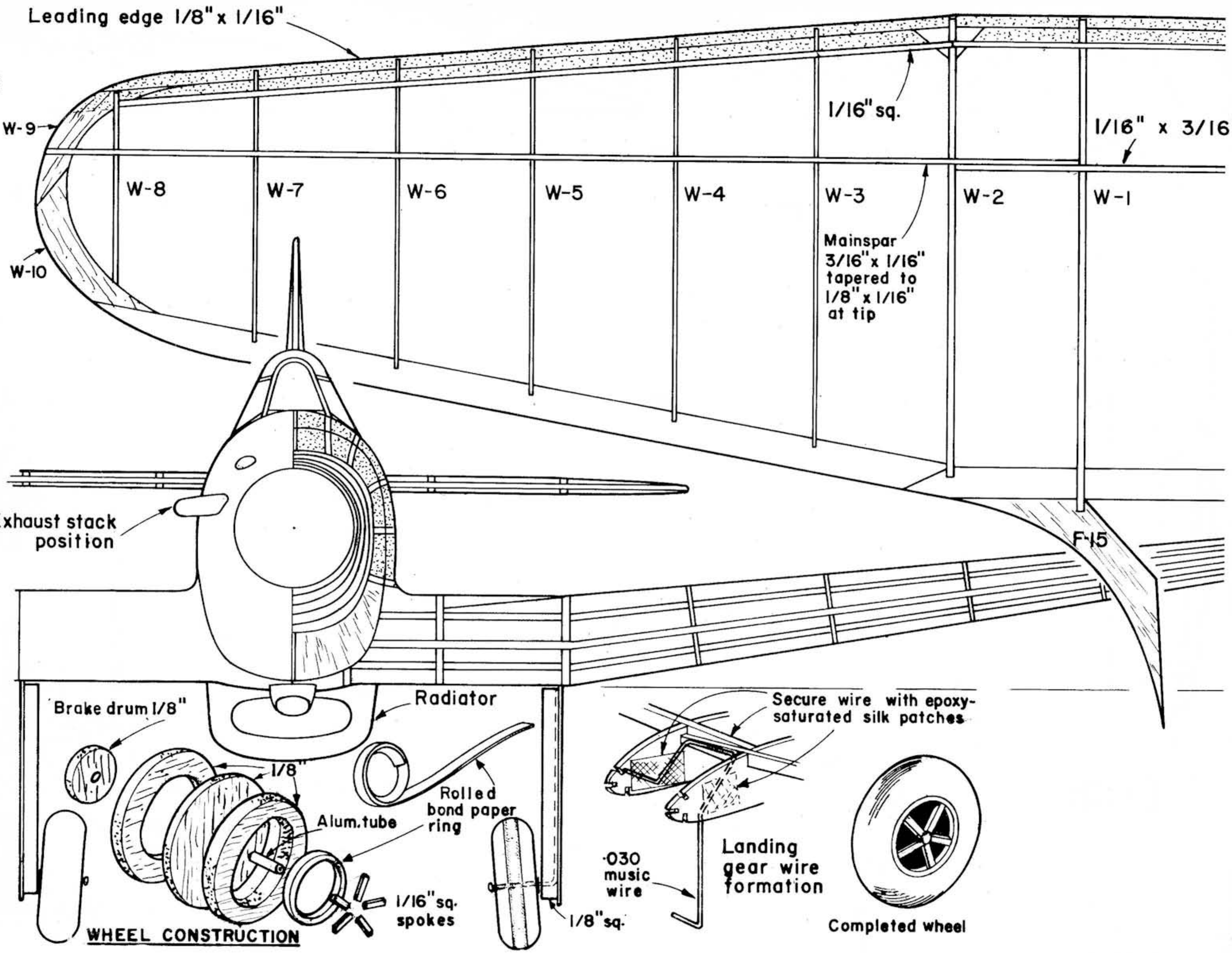


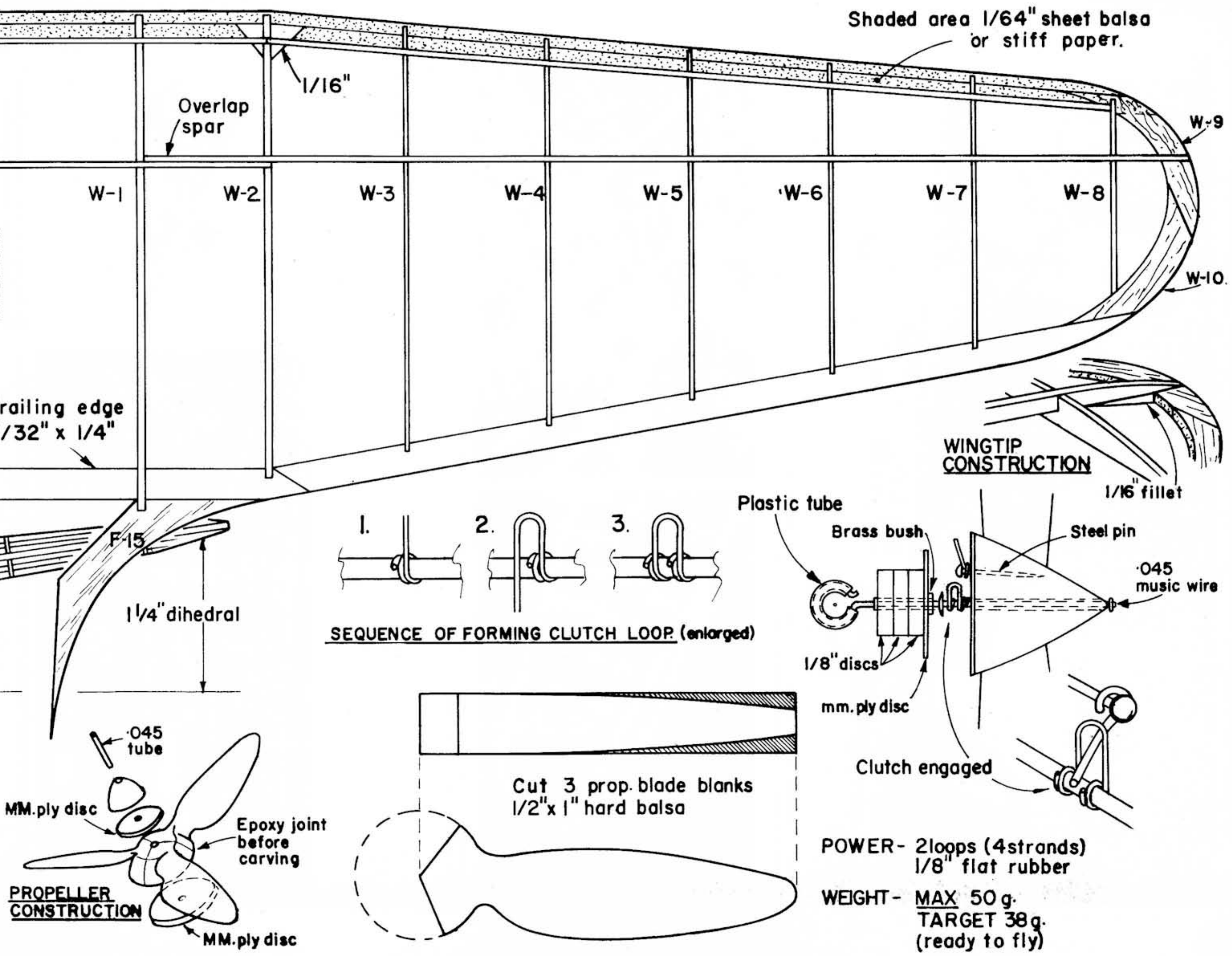
# Hawker HURRICANE I

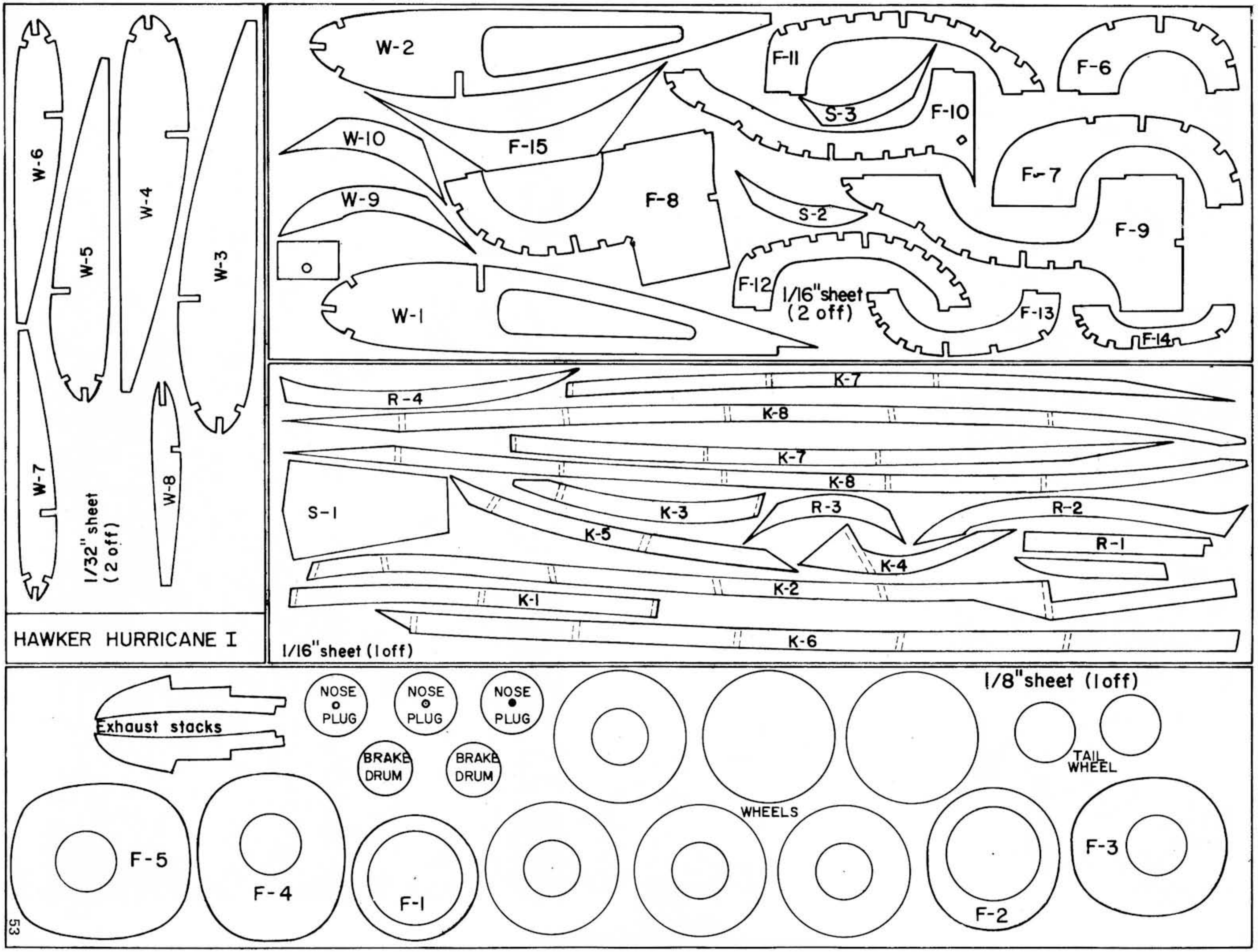
DESIGNED & DRAWN by J.D.McHard.
1/2" = 1'




R-3
R2
R-4
S-2
S-3
Position of 1/16"sq.
lightweight fuselage stringers
Extra stringers for greater realism
R-1
1/16" sq.
F-12
F-13
F-14
Elevator position
F-16
1/16" x 1/8"
K-6
3/32"
Scale tailplane areas
shown dotted
S-1
1/16" x 1/8"
Bamboo
Stiff paper
1/8"
tailwheel
Pattern for stiff (bond)
paper wing root fairing
Bamboo motor peg
K-8
1/16" x 1/8"
1/16"sq.
K-8
TAILPLANE
CONSTRUCTION
S-2
S-3


Leading edge 1/8" x 1/16"
1/16" sq.
1/16" x 3/16"
W-9
W-10
W-8
W-7
W-6
W-5
W-4
W-3
W-2
W-1
Mainspar
3/16" x 1/16"
tapered to
1/8" x 1/16"
at tip
Exhaust stack
position
F-15
Radiator
Brake drum 1/8"
1/8"
Alum. tube
Rolled
bond paper
ring
1/16" sq.
spokes
WHEEL CONSTRUCTION
1/8" sq.
Secure wire with epoxy-
saturated silk patches
·030
music
wire
Landing
gear wire
formation
Completed wheel


Shaded area 1/64" sheet balsa or stiff paper.
1/16"
Overlap spar
W-1
W-2
W-3
W-4
W-5
W-6
W-7
W-8
W-9
W-10
Trailing edge 3/32" x 1/4"
WINGTIP CONSTRUCTION
1/16" fillet
F-15
1 1/4" dihedral
1.
2.
3.
SEQUENCE OF FORMING CLUTCH LOOP (enlarged)
Plastic tube
Brass bush
Steel pin
·045 music wire
1/8" discs
mm. ply disc
Clutch engaged
·045 tube
MM.ply disc
Epoxy joint before carving
PROPELLER CONSTRUCTION
MM.ply disc
Cut 3 prop. blade blanks 1/2" x 1" hard balsa
POWER - 2loops (4strands) 1/8" flat rubber
WEIGHT - MAX 50 g. TARGET 38 g. (ready to fly)


HAWKER HURRICANE I
W-1
W-2
W-3
W-4
W-5
W-6
W-7
W-8
W-9
W-10
1/32" sheet (2 off)
F-6
F-7
F-8
F-9
F-10
F-11
F-12
F-13
F-14
F-15
S-2
S-3
1/16" sheet (2 off)
R-1
R-2
R-3
R-4
K-1
K-2
K-3
K-4
K-5
K-6
K-7
K-8
S-1
1/16" sheet (1 off)
Exhaust stacks
NOSE PLUG
NOSE PLUG
NOSE PLUG
BRAKE DRUM
BRAKE DRUM
WHEELS
TAIL WHEEL
1/8" sheet (1 off)
F-1
F-2
F-3
F-4
F-5


**The author's model of the Spitfire is based on the aircraft flown by Pilot Officer A.S.C. Lumsden, stationed at Ibsley in 1941 with No. 118 Sqdn.**

# SUPERMARINE SPITFIRE

**By J. D. McHARD**

● The Spitfire's elegant lines are still, nearly forty years after they first took the air on 5th March, 1936, regarded by many as representing the pinnacle of piston engined monoplane fighter designed.

The elliptical wing and smooth stressed skin construction was more costly and complex than the contemporary Hurricane, but they conferred upon the "Spit" an edge of performance that ensured its continuance in first line service throughout . . . and after . . . the entire second World War.

Production commenced in March 1937, the first machine off the line flying in June, 1938. The Spitfire entered squadron service with No. 19 Sqdn. at Duxford in August 1938, and by the outbreak of war, the following September, over 2,000 Spitfires were on order.

By July, 1940, nineteen Spitfire squadrons were on the R.A.F.'s strength and in the Battle of Britain which followed, the machine's superior performance was more than a match for the Luftwaffe fighters.

Continuous development had produced an airspeed of over 360 mph., and the eight wing-mounted Brownings marked an enormous forward leap in aircraft armament.

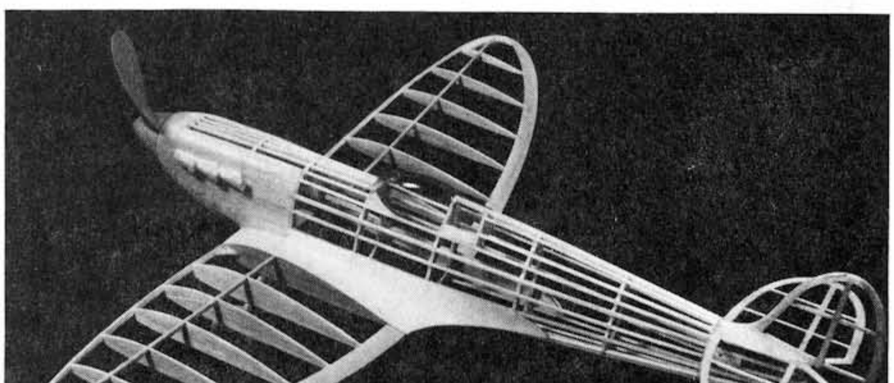
Our model is based upon the machine flown by Pilot Officer A.S.C. Lumsden, stationed at Ibsley in 1941 with No. 118 Sqdn.

CONSTRUCTION

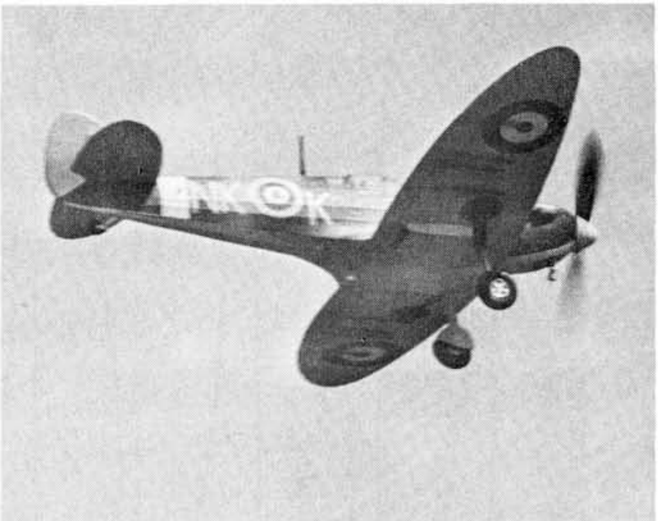
The early marks of Spitfire have always been tempting subjects for scale modellers. In classic design terms, it remains one of the most beautiful machines of all time. It is, however, in model form, not the easiest of subjects. The elliptical flying surfaces are more difficult to build than straight outline types, and the short nose gives rise to balance problems in a rubber powered model. Remember that fractions of an ounce saved behind the balance point will significantly improve flying performance, by reducing the considerable amount of dead weight that must be placed in the short nose to achieve the correct center of gravity.

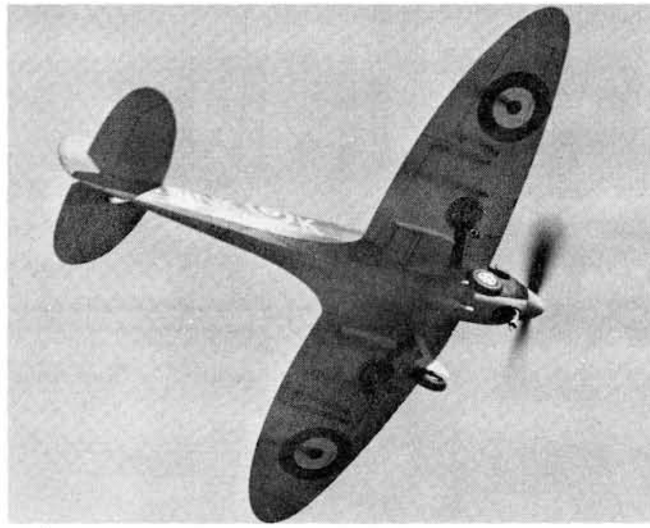
The original model was converted for use with the Brown Jr. $CO_2$ engine, and the elimination of the rubber motor behind the wing resulted in the saving of a 1/4 ounce . . . not at all insignificant when one considers that the *total* weight is less than 1-1/2 oz!

Quite apart from the improved performance resulting from the lighter



**Classic lines of the Spitfire are evident even in its uncovered state.**





**Some time after the lead photo had been taken, the Spitfire was converted from rubber to $CO_2$ power. In these two photos, the $CO_2$ filler fitting can be seen underneath, just behind the propeller. The installation of the $CO_2$ engine is detailed on the plans.**

model, trimming is greatly simplified, and adjustments become far less critical. So the message is clear . . . watch your weight!

FUSELAGE

Carefully join the pages together to produce a full fuselage plan. Line up the plan halves by placing a ruler along the center-line on K-6 and K-7 and the top view center keels. Hold the plan firmly with adhesive tape, then cover it with transparent greaseproof paper to prevent cement from damaging the plan.

Cut out all formers and keel pieces. Cement all keels together where shown, lining them up carefully over the plan. Pin down K-1, 2, 3, 4, and 5 over side view and assemble former halves F-7, F-8, and F-9.

Carefully cement half-formers F-5 to F-13 (except F-10) to the keels, ensuring that they are all perfectly vertical. Now add side keels K-6 and K-7 and root rib R-1. Carefully cement the 1/16 square stringers in place, correcting any inaccurately cut slots as you go to ensure smooth stringer "runs" without kinks. Place F-14 and fit the small triangular fillets against R-1.

When dry, remove the half shell from the plan, fit former F-10, and built the port side directly onto the shell in the same sequence described above. In doing so, make sure that the top and bottom keels remain straight fore and aft as stringers are added. The 3/32 square center section wing leading edge is now cemented in place.

Now add formers F-1 to F-5, aligning them by their center holes. Now the nose can be filled in with 1/16 inch sheet. Leave the panels a little "proud" (sticking out) of the surface to allow for sanding to correct contour. The lower nose blocks are now cut and cemented in place.

Mold the cockpit cover from thin acetate and check the fit, removing the top keel section between F-9 and F-10. Fit the rear rubber anchorage plate and the fuselage is now complete.

WINGS

Cut out all 1/32 ribs and the 3/32 trailing edge and tip parts. Assemble W-8, 9, and 10 and carefully cut and sand to section shown, being sure to make one left and one right handed.

Pin down over plan and cement ribs in place, lining them up with the spar slots. Steam the 3/32 square leading edges to the correct curve then cement in place. Now taper the spar from 1/16 x 1/8 at the root to 1/16 square at the tip, then cement in place, ensuring sufficient overhang at the root as shown.

When dry, remove from plan, and with the fuselage on a flat surface, fix both wing panels in place. Sand the root ends of the leading and trailing edges to butt properly against rib R-1. Prop up the wing tips 1-1/4 inches, and using plenty of cement, secure the panels in place, ensuring that the spars form a straight line in plan view from wing tip to tip, with no sweep forward or back.

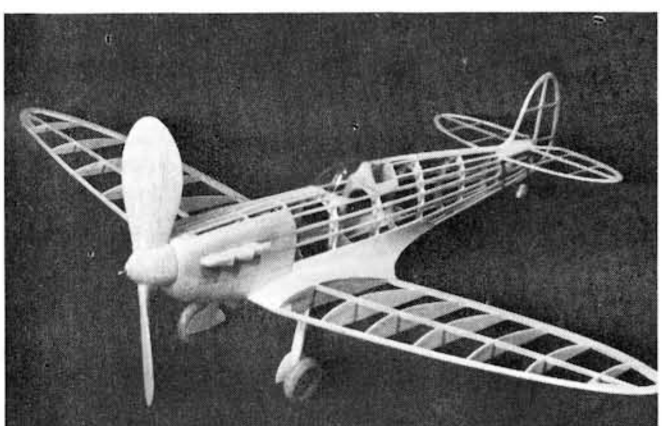
When dry, fix the 1/16 square radiator support strips under ribs R-1 & R-2.

TAILPLANE

Build the tail surfaces flat on the plan. When dry, remove, and assemble as shown, with small soft balsa fairings to blend into the rear fuselage lines. The tailwheel is assembled and securely cemented into a slot cut in K-5. Reinforce the keel with scrap 1/16 sheet either side at this point if necessary.

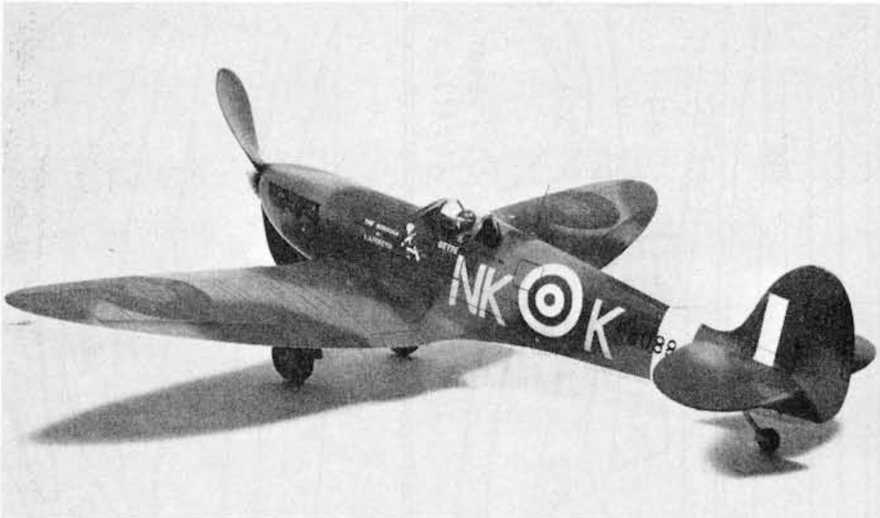
UNDERCARRIAGE

Bend the U/C wire as shown and fix with epoxy to F-7. Take care to make

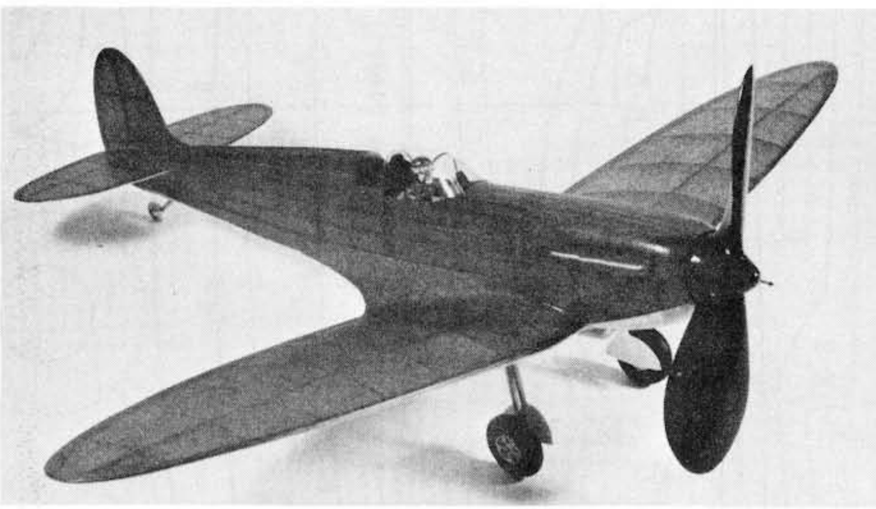


**Wide propeller blades result from obtaining the needed area without increasing diameter, which would mean long, non-scale landing gear.**

**Complete details on obtaining a camouflage finish as shown above will be found in the author's finishing article, starting at page 127.**




**Note how the shading at the leading edge of the aileron gives it a curved appearance. This and many other fine touches is what makes the difference between a fair and excellent scale model.**



**Note the generous blade area of the propeller in this photo of the Spitfire before the final finish was applied. Carving of balsa props for rubber power is covered on page 124.**

both legs of equal length. Place the two reinforcing plates over the wire before the glue dries. Half-rounded 3/32 x 3/32 legs are grooved to accept the wire and then glued to the card wheel well covers with the U/C wire sandwiched between.

DETAILS

Cut the two wing fillets from stiff paper, and using cellulose glue, fix in place, holding with the fingers until dry.

Carve air intakes, exhaust stacks etc. and put aside to fix after covering.

The propeller assembly is clearly shown on the plan, and details of a free wheeling clutch are also given. The original model had the clutch hidden inside the spinner and thus it does not show in the photographs. The type suggested here is easier to construct for the average builder.

Wheel construction is also clearly shown on the plan. Be sure to round off the tire laminations to half-round section before cementing in place. Use epoxy to fix the aluminum tube bushing in place.

Covering is carried out in sections in the normal manner as described elsewhere.

FLYING

Balance the Spitfire at Former F-7 position. Any tail heaviness must be corrected by adding weight to the nose before glide testing.

A small, clear acetate trim tab is fixed to the starboard wing and turned up about $5^{o}$. The model should be allowed to turn left under the influence of propeller torque and about $2^{o}$ right side-thrust should be built in to keep the nose up in the turn. The wing tab is adjusted to prevent the outside (starboard) wing from rising too far. Too much up tab will produce a right turn which must be avoided, as it will result in a spiral dive. Very little down-thrust was needed on the original model.

$CO_2$ CONVERSION

Details are given on the plan for the fitting of a Brown Jr. $CO_2$ engine. This is the ideal power unit for short nose models such as the Spitfire.

Note that fuselage former F-5 (revised) is placed 1/8 inch farther back from the nose than on the rubber powered version.

Cut the openings in F-5 and in the fuselage underside for the gas bottle, *after* shaping the nose.

The lower nose blocks are hollowed out to a wall thickness of 3/16 inch to allow the $CO_2$ bottle to be placed.

REFERENCES

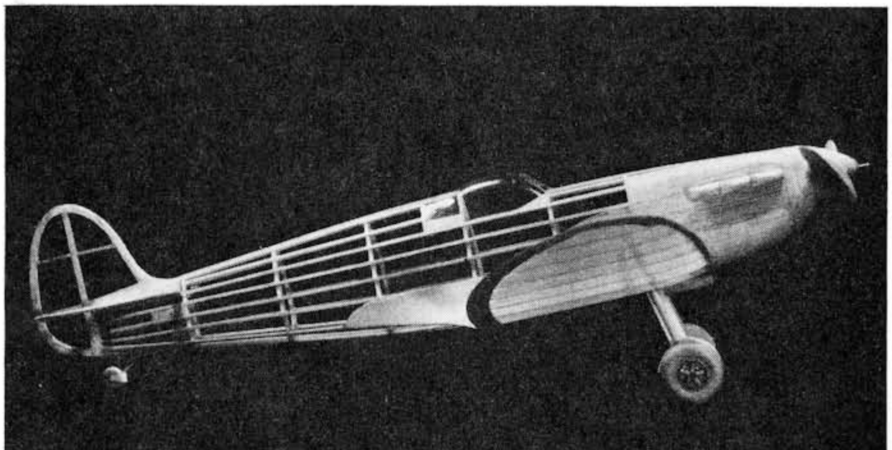
Detailed scale drawings - Aeromodeller Plans Service
Spitfire Mk. 1 - Model & Allied Publications Ltd.
13-35 Bridge Street,
Hemel Hempstead, Herts., England.

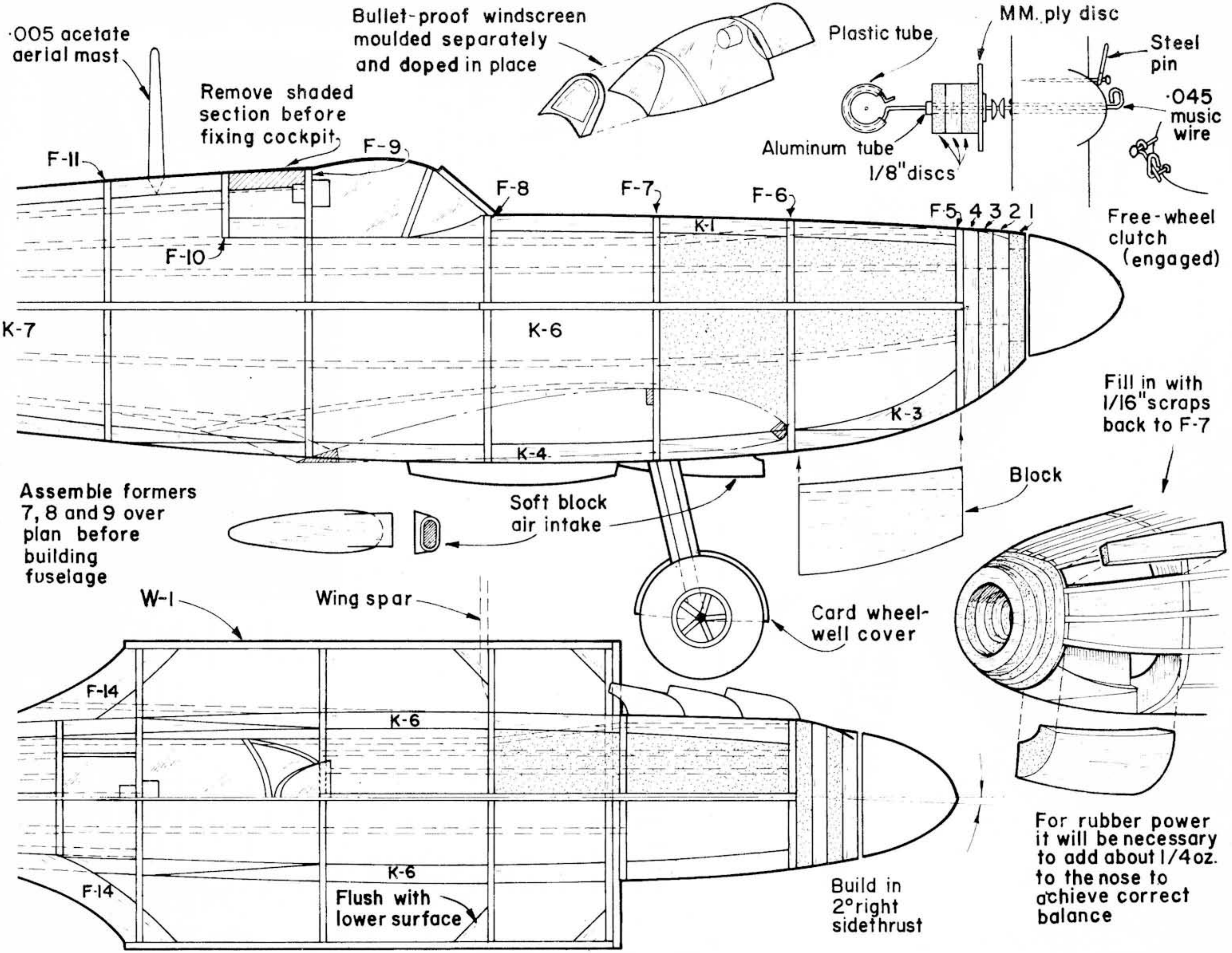
Colour schemes - Profile No. 41. "Supermarine Spitfire 1 & 2"
Condensed history - Profile Publications Ltd.,
Coburg House, Sheet Street,
Windsor, Berks., England.

Comprehensive marque coverage & drawings (general detail only) - "SPITFIRE, Story of a Famous Fighter"
Harleyford Publications Ltd.
from M.A.P. Ltd. 13-35 Bridge St.,
Hemel Hempstead, Herts, England.

General type details - "SPITFIRE" Aircam Publications

1/48th scale drawings - Scale Models magazine April 1971
(M.A.P. Ltd.) ●



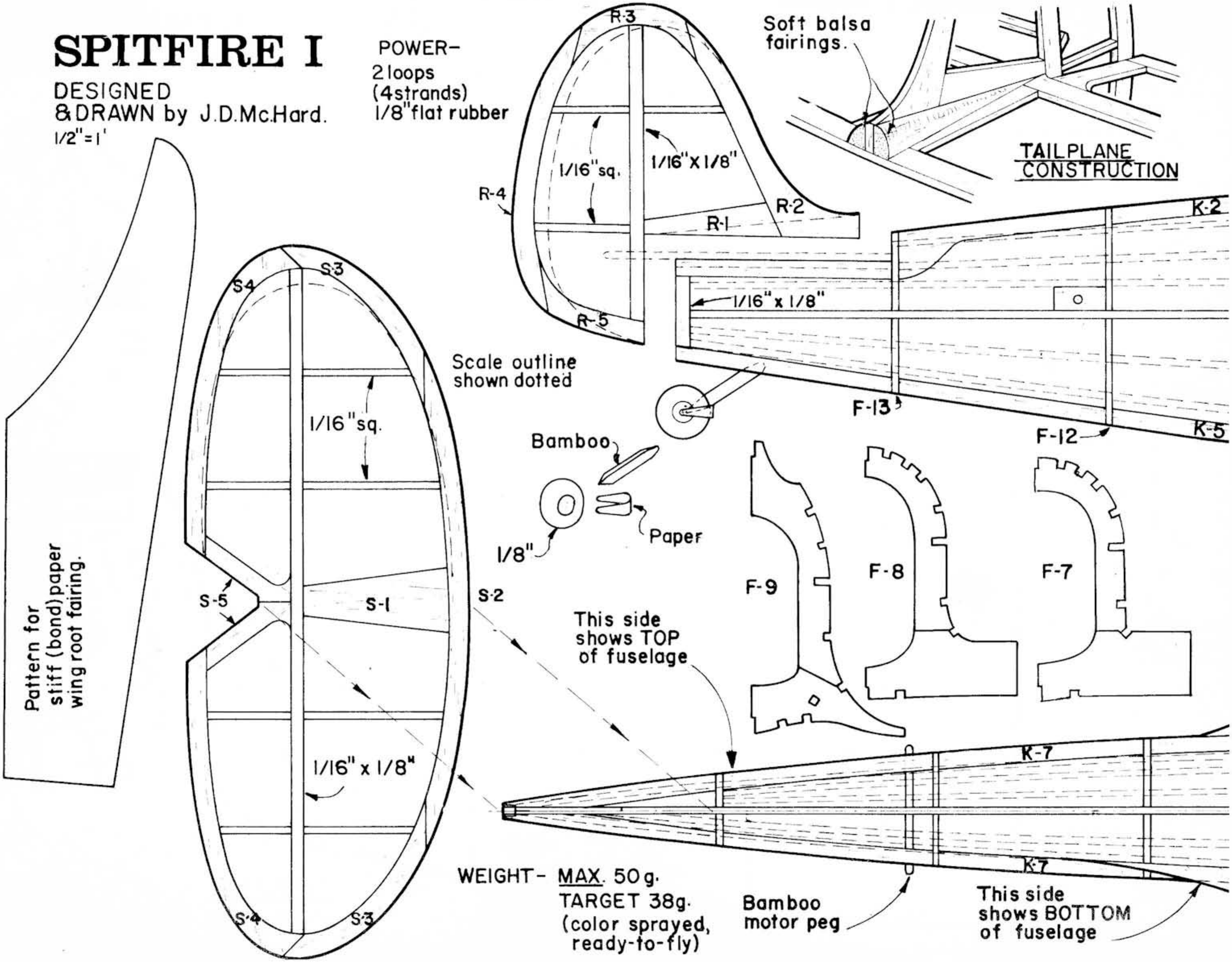


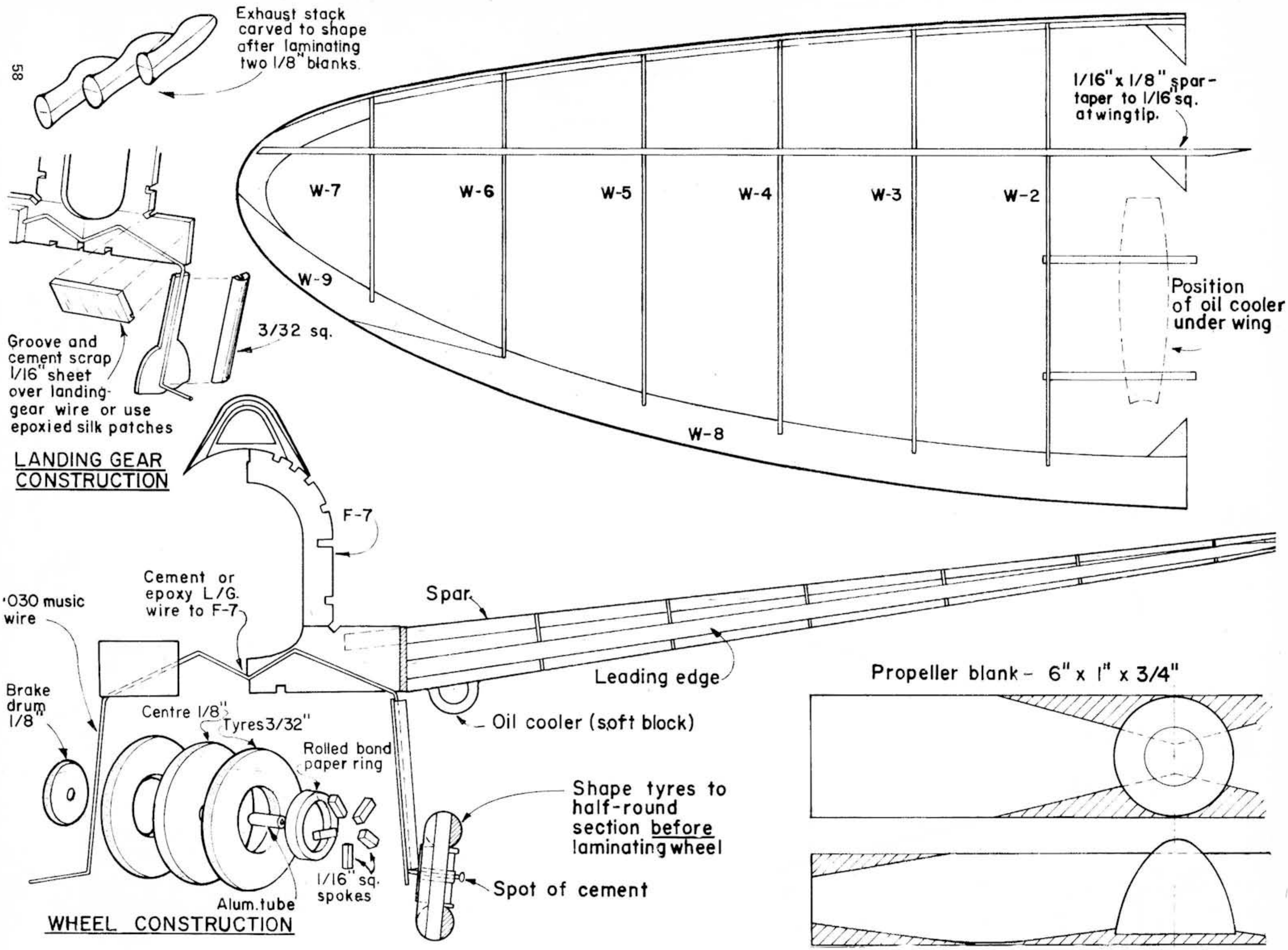
·005 acetate aerial mast
Bullet-proof windscreen moulded separately and doped in place
Plastic tube
MM. ply disc
Steel pin
·045 music wire
Aluminum tube
1/8" discs
Remove shaded section before fixing cockpit
F-11
F-9
F-8
F-7
F-6
F-5
4
3
2
1
K-1
F-10
Free-wheel clutch (engaged)
K-7
K-6
K-3
K-4
Fill in with 1/16" scraps back to F-7
Block
Assemble formers 7, 8 and 9 over plan before building fuselage
Soft block air intake
W-1
Wing spar
Card wheel-well cover
F-14
K-6
K-6
F-14
Flush with lower surface
Build in 2° right sidethrust
For rubber power it will be necessary to add about 1/4 oz. to the nose to achieve correct balance

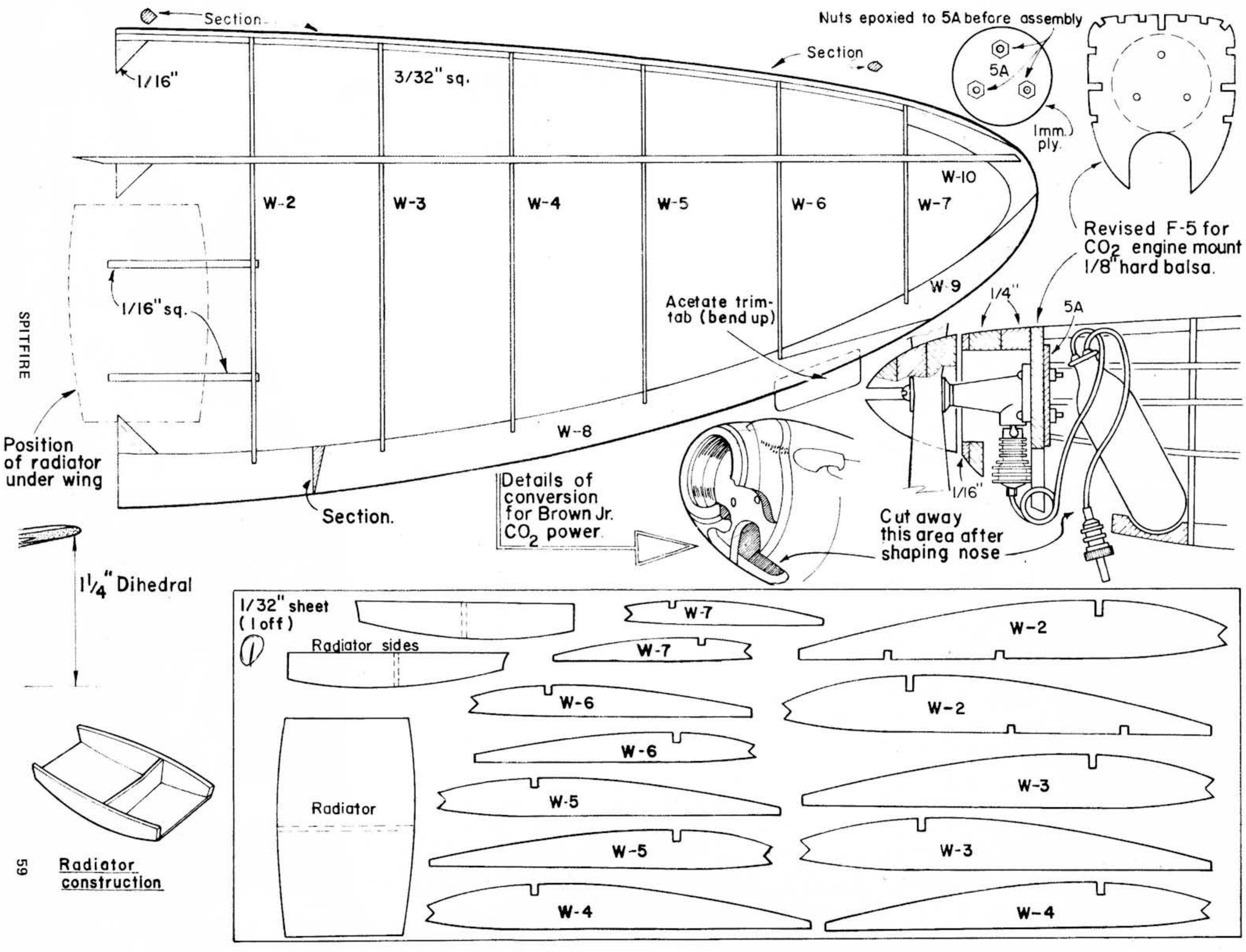
# SPITFIRE I

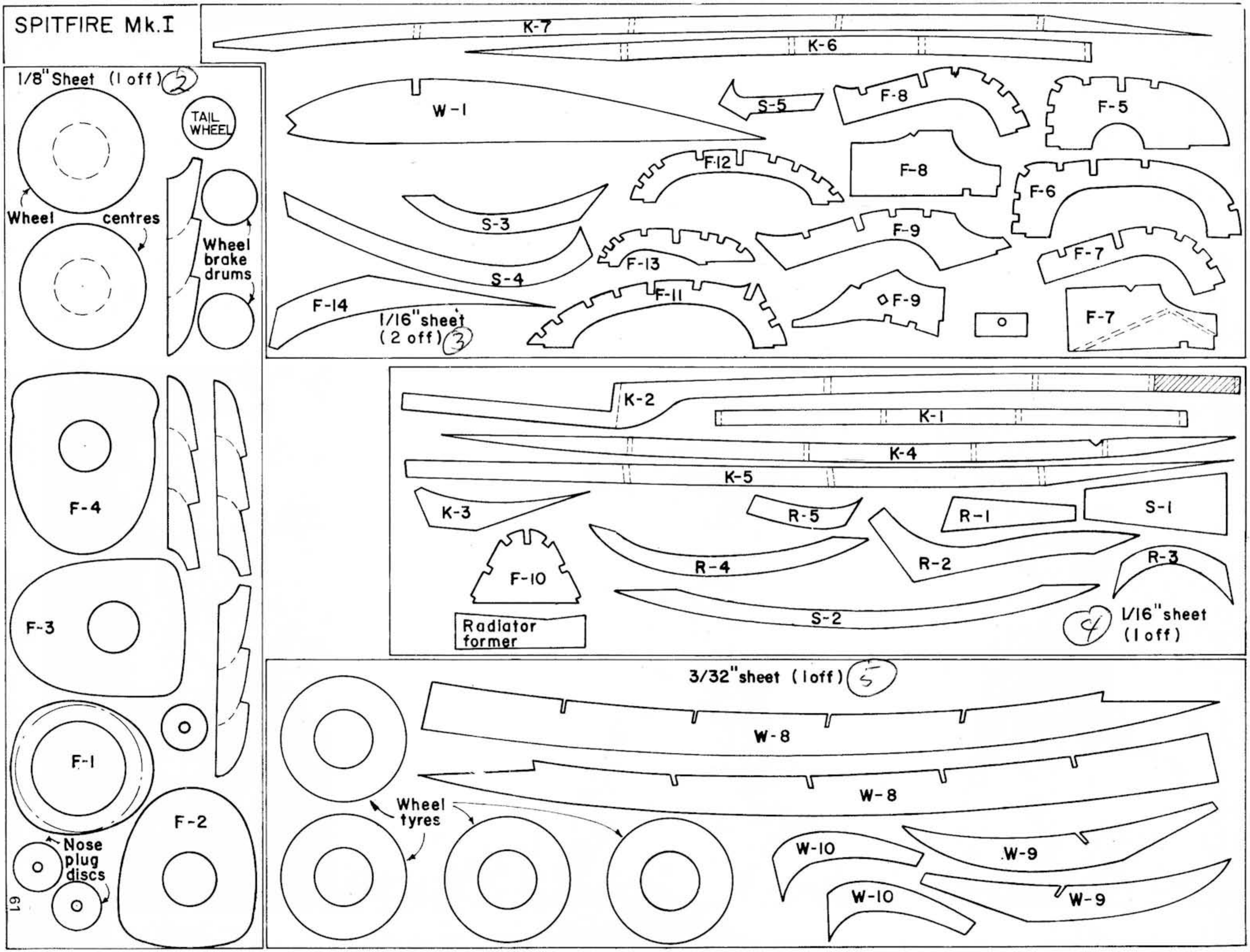
DESIGNED
& DRAWN by J.D.Mc.Hard.
1/2"=1'

POWER–
2 loops
(4 strands)
1/8" flat rubber




Exhaust stack
carved to shape
after laminating
two 1/8" blanks.
1/16" x 1/8" spar-
taper to 1/16" sq.
at wingtip.
W-7
W-6
W-5
W-4
W-3
W-2
W-9
W-8
Position
of oil cooler
under wing
3/32 sq.
Groove and
cement scrap
1/16" sheet
over landing-
gear wire or use
epoxied silk patches
LANDING GEAR
CONSTRUCTION
F-7
Cement or
epoxy L/G.
wire to F-7
·030 music
wire
Spar
Leading edge
Propeller blank - 6" x 1" x 3/4"
Brake
drum
1/8"
Centre 1/8"
Tyres 3/32"
Rolled band
paper ring
Oil cooler (soft block)
Shape tyres to
half-round
section before
laminating wheel
1/16" sq.
spokes
Alum. tube
Spot of cement
WHEEL CONSTRUCTION


Section
1/16"
3/32" sq.
Section
Nuts epoxied to 5A before assembly
5A
1mm. ply.
W-10
W-2
W-3
W-4
W-5
W-6
W-7
Revised F-5 for $CO_2$ engine mount 1/8" hard balsa.
1/16" sq.
W-9
Acetate trim-tab (bend up)
1/4"
5A
Position of radiator under wing
W-8
1/16"
Details of conversion for Brown Jr. $CO_2$ power
Cut away this area after shaping nose
Section.
1 1/4" Dihedral
1/32" sheet (1 off)
Radiator sides
W-7
W-7
W-2
W-2
W-6
W-6
W-5
W-5
W-3
W-3
W-4
W-4
Radiator
Radiator construction


SPITFIRE Mk.I
1/8" Sheet (1 off) 2
TAIL WHEEL
Wheel centres
Wheel brake drums
F-4
F-3
F-1
F-2
Nose plug discs
K-7
K-6
W-1
S-5
F-8
F-5
F-12
F-8
F-6
S-3
F-9
F-13
S-4
F-7
F-14
F-11
1/16" sheet (2 off) 3
F-9
F-7
K-2
K-1
K-4
K-5
K-3
R-5
R-1
S-1
R-4
R-2
R-3
F-10
S-2
Radiator former
1/16" sheet (1 off) 4
3/32" sheet (1off) 5
W-8
W-8
Wheel tyres
W-10
W-9
W-10
W-9

The characteristic splayed landing gear of the Bf 109E is very evident in this photo of the author's model. Markings are from the 8/J G.1., with yellow under-nose and wing tip undersides, and black "13" outlined in red.

# MESSERSCHMITT Bf-109 By J. D. McHARD

● The compactness of the Bf 109E is brought home in no uncertain manner when this model is viewed alongside the other models in this book . . . all of which are to the same 1/24th scale. It was a small machine, even by contemporary standards, and for example, the Hawker Hurricane and Thunderbolt look positively gigantic in comparison!

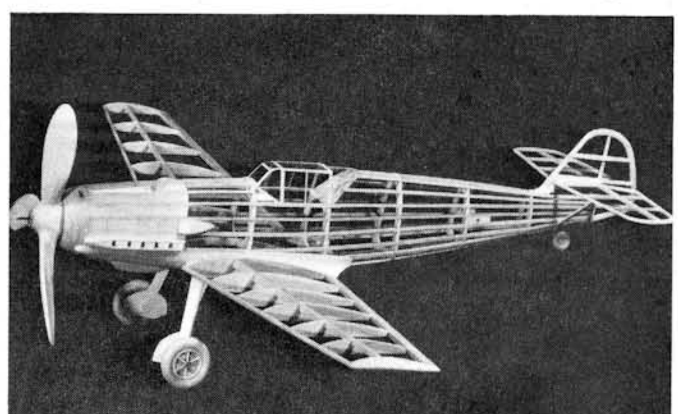
The Messerschmitt design was commenced in 1934 and it was the first fighter to be developed by the company. It was of advanced design, employing stressed skin construction, and the prototype flew in September the following year . . . with a Rolls Royce engine!

Armament was inferior to the British Spitfire and Hurricane, each of which carried eight .303 wing mounted machine guns. The Bf 109 initially had only two top fuselage mounted, rifle caliber guns and one more (later to be replaced by a 20 mm. cannon) firing through the hollow propeller shaft. The production Bf 109E carried two wing mounted 20 mm. cannon and two fuselage mounted MG17s.

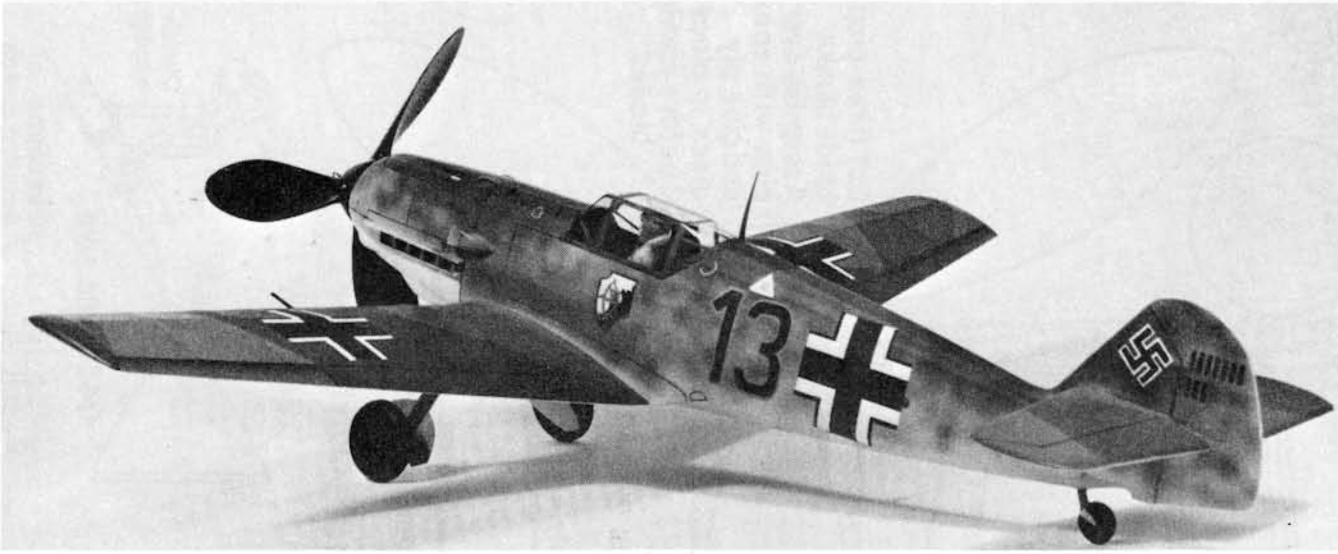
Blooded in the Spanish civil war, the 109 went on to achieve the largest production run of any World War II aircraft. It served in all European and North African theaters of war and was well like by its pilots.

Top speed was 357 mph, and although some performance characteristics showed certain shortcomings, in

The covered Messerschmitt, ready for its final finish, is the smallest model in this series, though all are to 1/2" = 1' scale.



Framework shot reveals the use of fill-in sheeting around the nose. Being small, weight must be carefully kept to a minimum.



**This photo again illustrates how skillful use of an airbrush can give a three-dimensional effect to the ailerons.**

practice, the machine was closely matched to its British opposite numbers. The outcome of a dog fight would depend much more upon the relative skills of the opposing pilots than upon any performance advantage of the respective aircraft.

Our model is based upon a machine of 8/J G.1. with yellow under-nose and wing tip undersides and black "13" outlined in red.

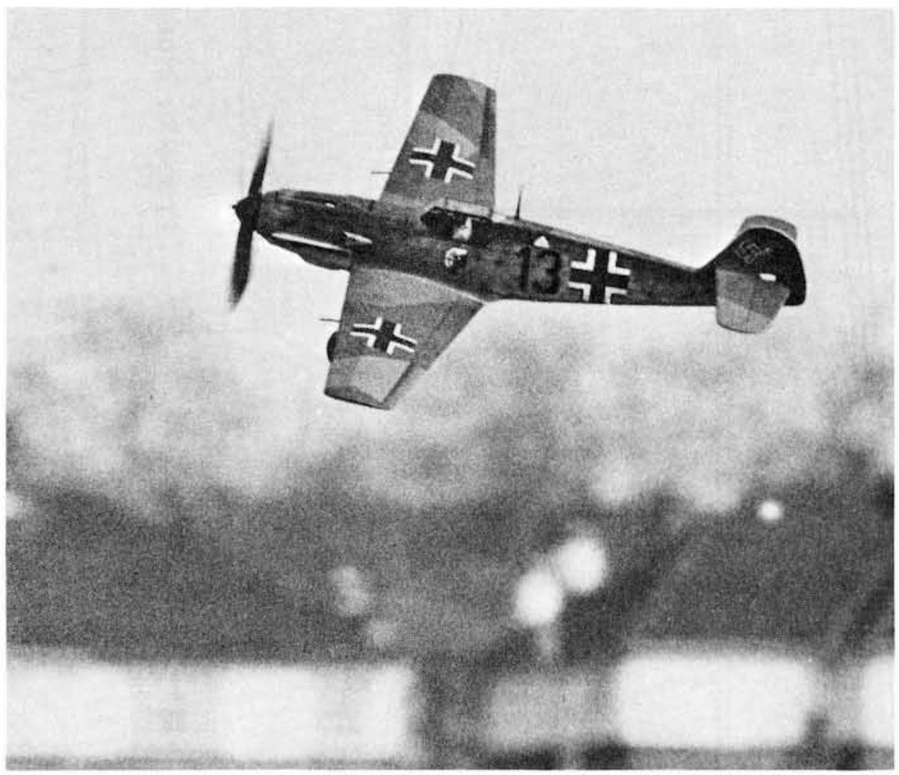
CONSTRUCTION

As previously mentioned, the smallness of the 109 is not generally appreciated until it is compared with a series of similarly scaled fighter aircraft, such as those contained in this book. In order to retain flying performance it is even more important than in larger models to watch the weight. The structure is therefore quite severely "edited" while at the same time an attempt has been made to retain a relatively rugged airframe. It is very conventional, but care must be taken in assembly to ensure a warp-free model.

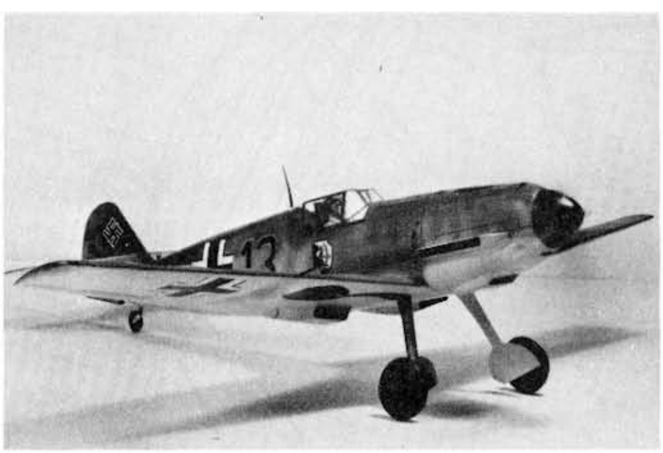
REFERENCES

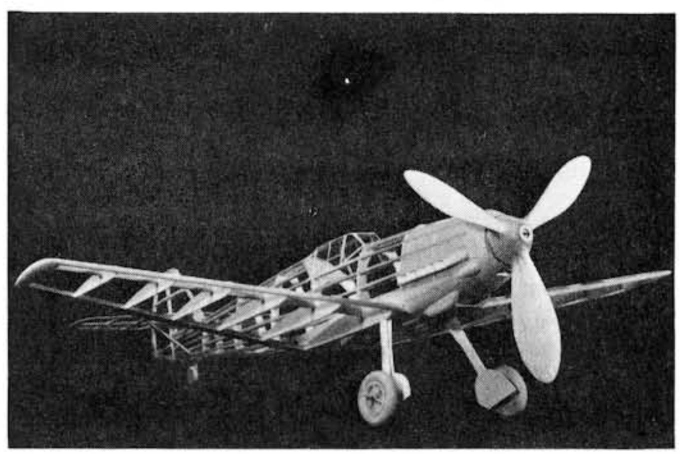
Profile Publications No. 40 "The Messerschmitt Bf-109E".

Aeromodeller plan and feature article.●



**With the fixed-down gear practically hidden, this action shot of the Messerschmitt is extremely realistic. Ship is a fast, stable flier.**

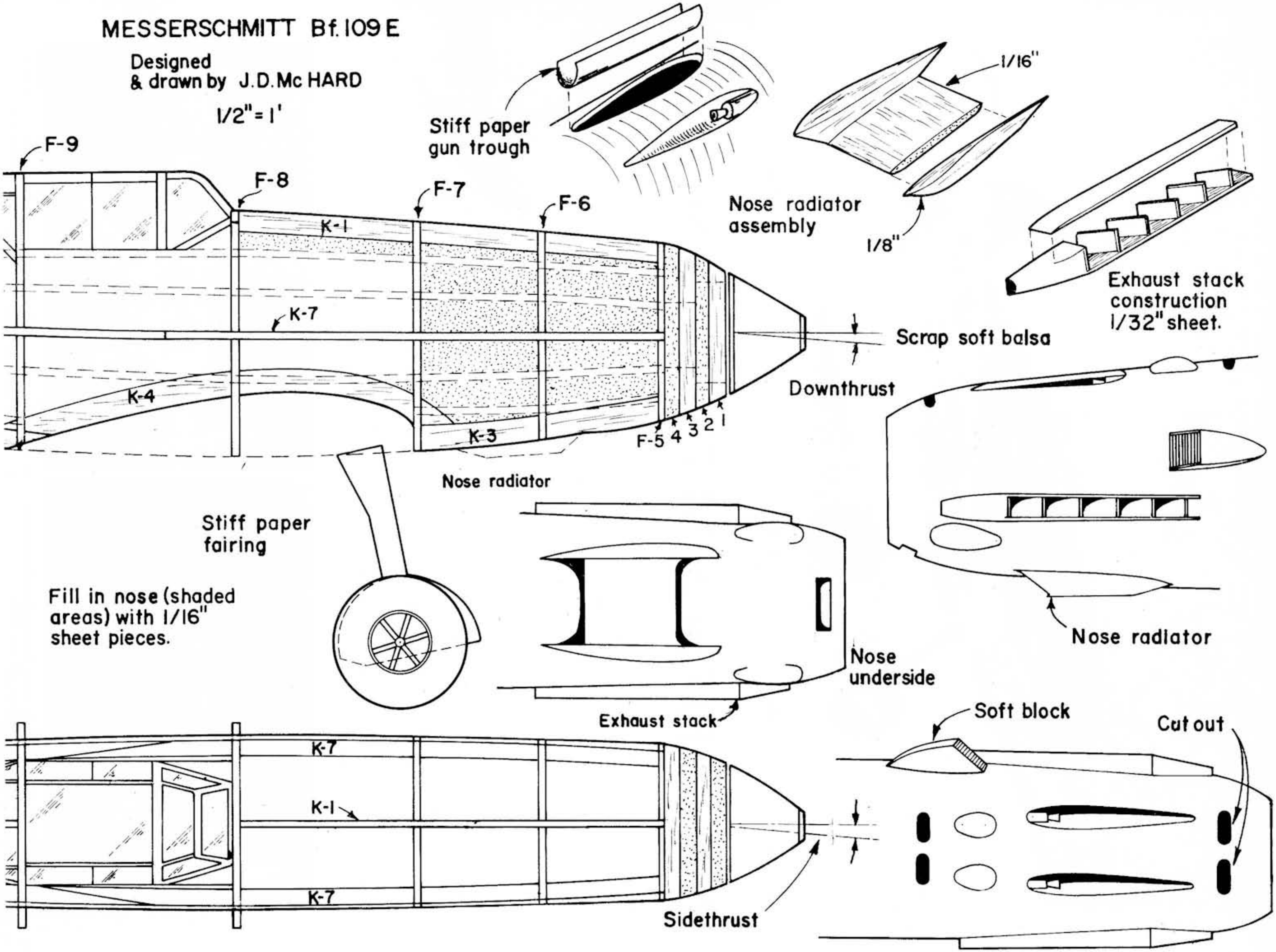


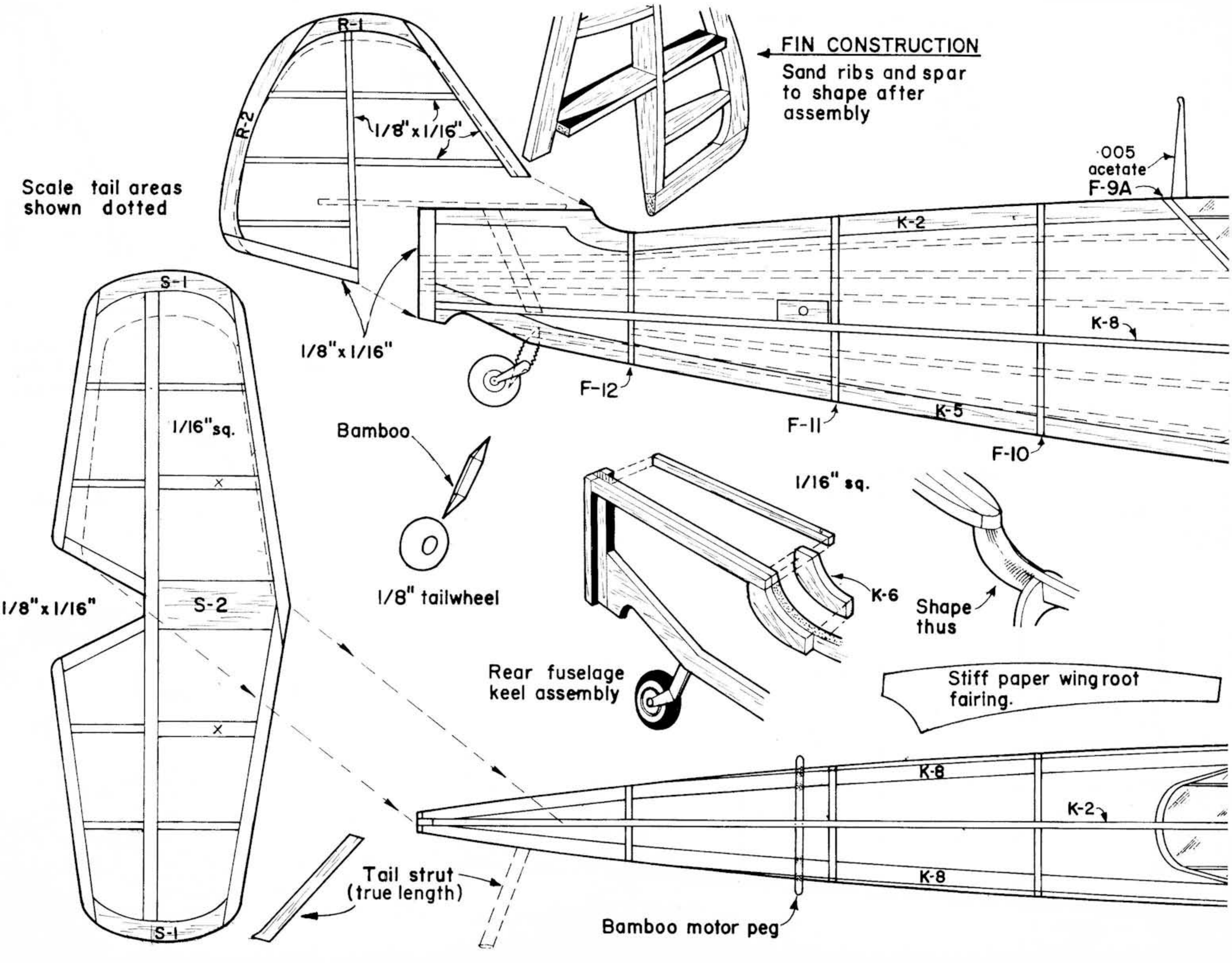


# MESSERSCHMITT Bf.109 E

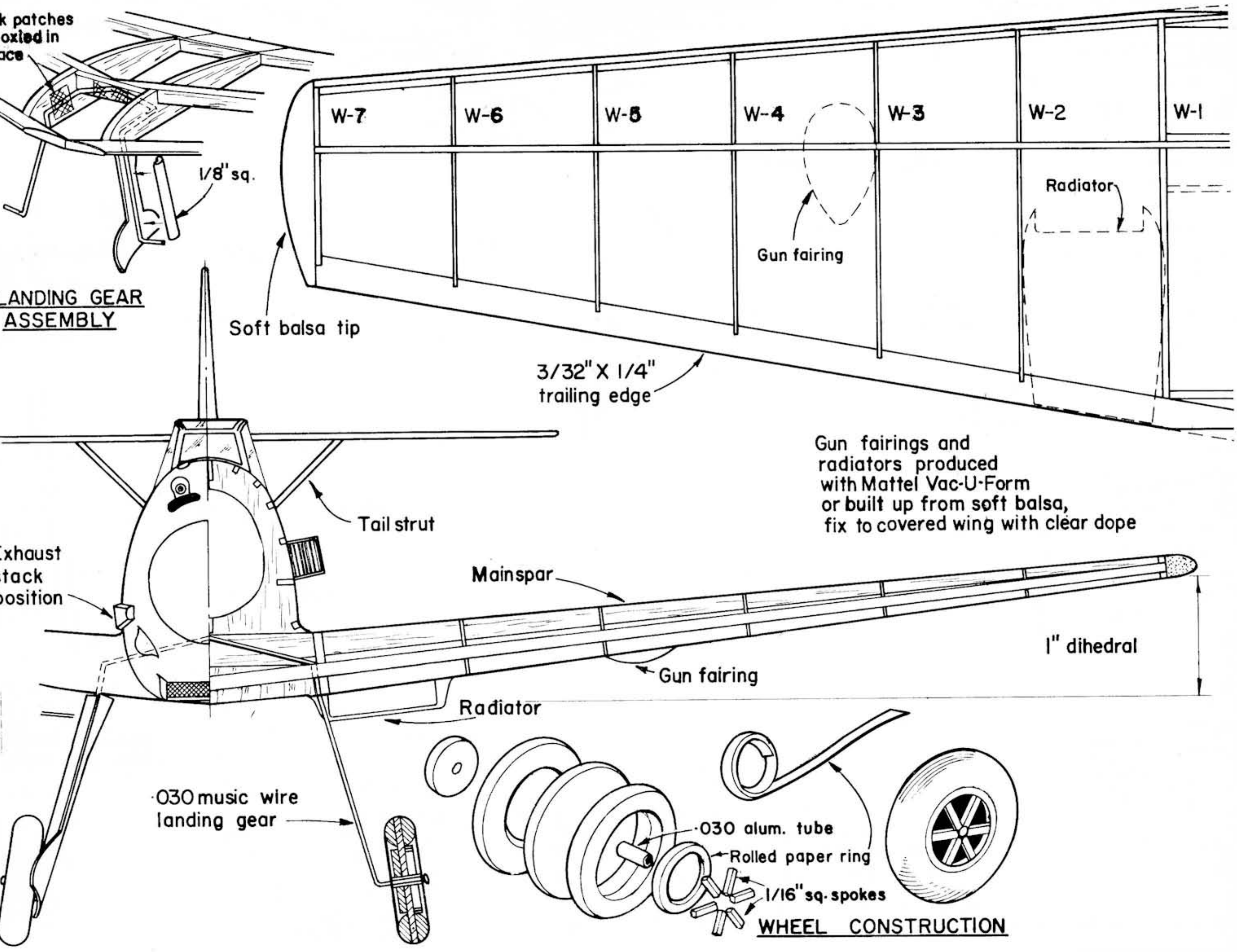
Designed
& drawn by J.D.Mc HARD

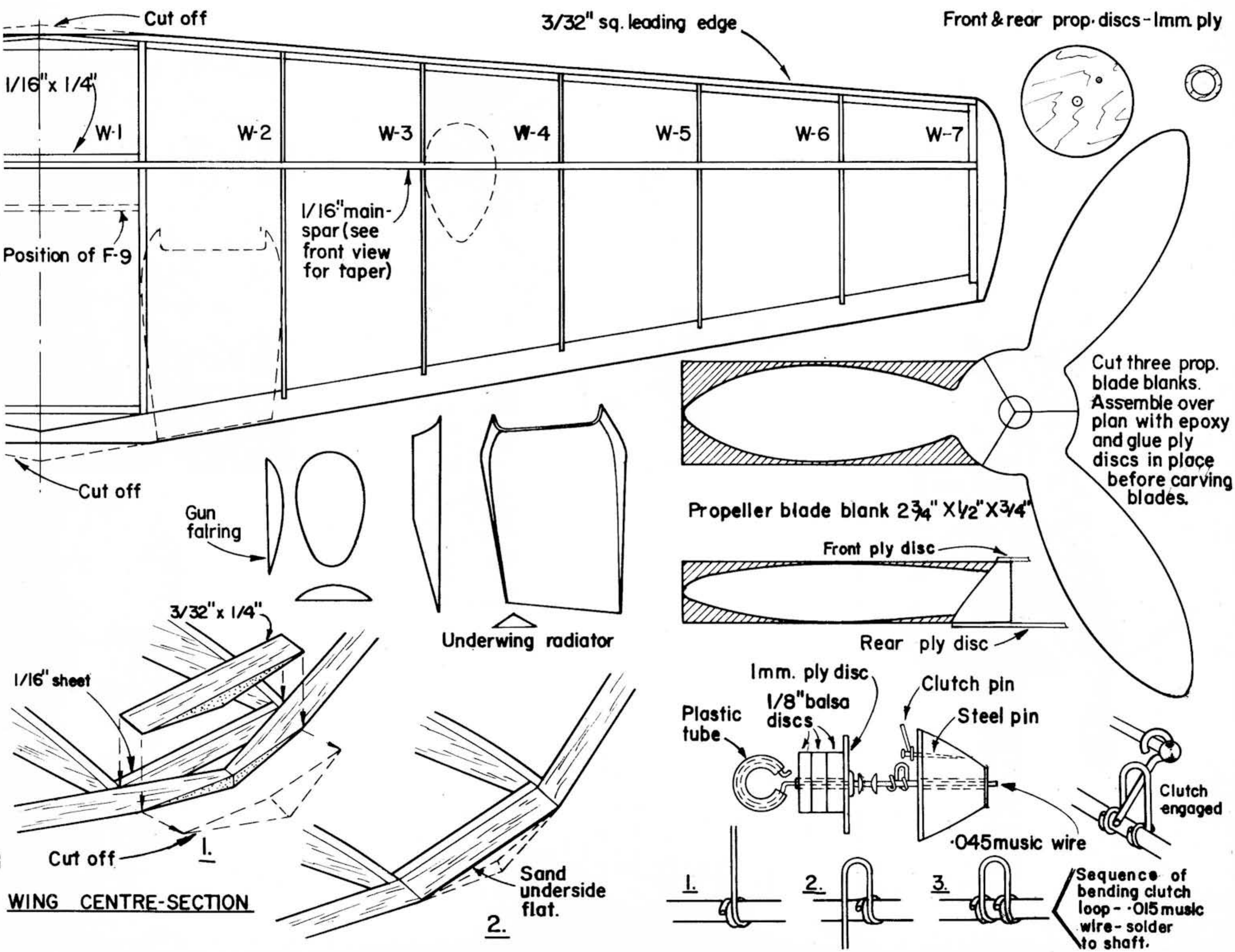
1/2" = 1'



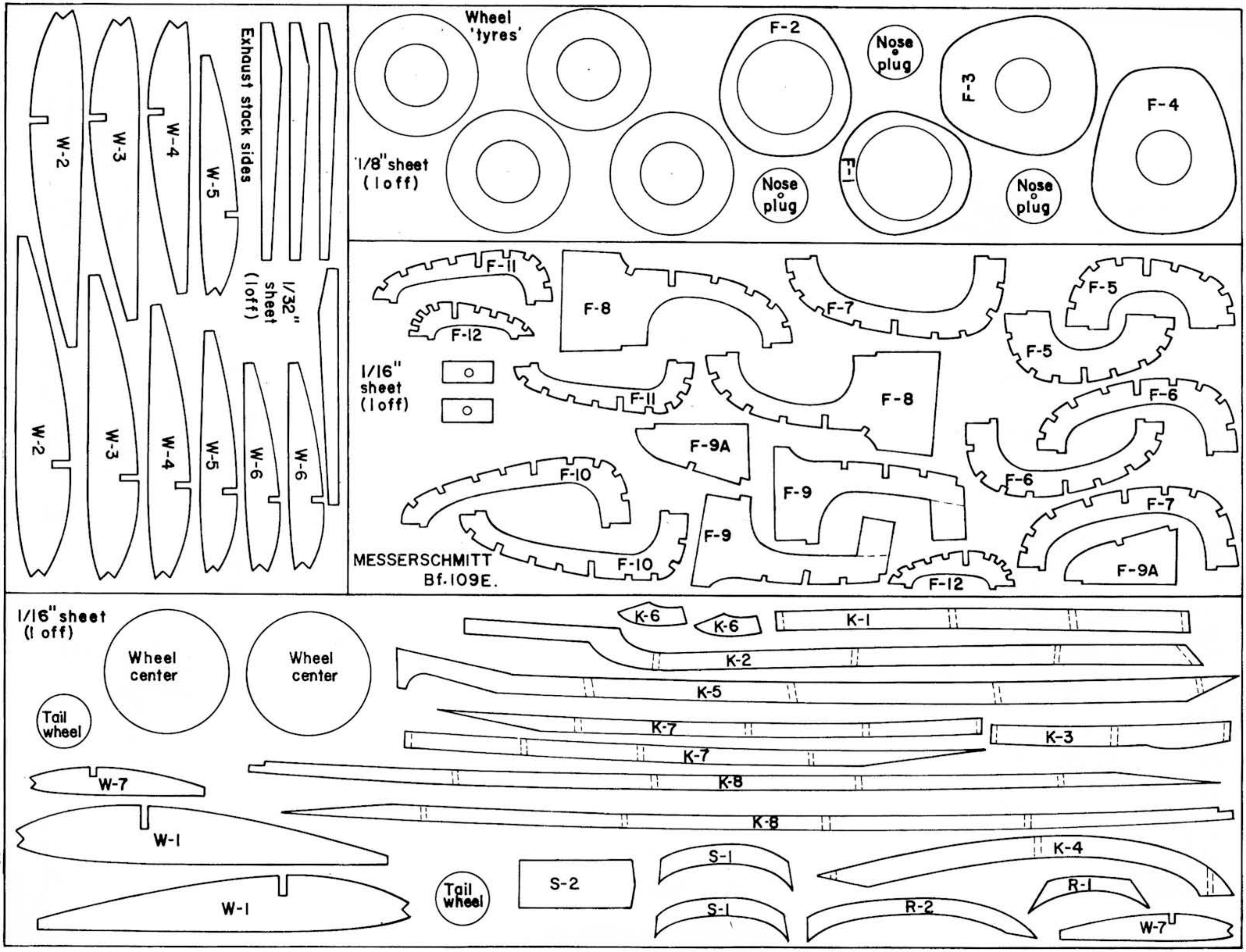


FIN CONSTRUCTION
Sand ribs and spar to shape after assembly
R-1
R-2
1/8"x1/16"
Scale tail areas shown dotted
·005 acetate
F-9A
K-2
K-8
1/8"x1/16"
F-12
F-11
K-5
F-10
S-1
1/16"sq.
Bamboo
1/8" tailwheel
1/16" sq.
K-6
Shape thus
1/8"x1/16"
S-2
Rear fuselage keel assembly
Stiff paper wing root fairing.
K-8
K-2
K-8
Tail strut (true length)
S-1
Bamboo motor peg

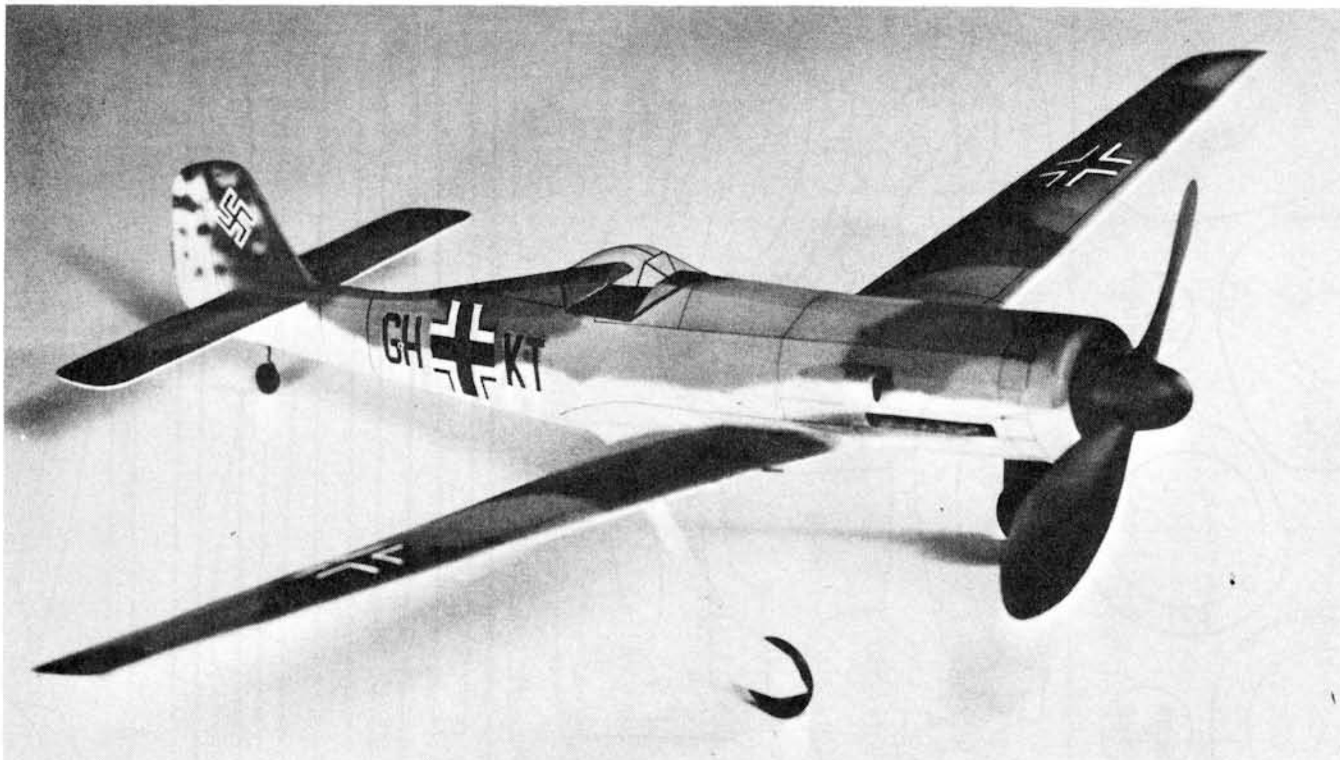

Silk patches epoxied in place
1/8" sq.
LANDING GEAR ASSEMBLY
W-7
W-6
W-5
W-4
W-3
W-2
W-1
Radiator
Gun fairing
Soft balsa tip
3/32" X 1/4" trailing edge
Gun fairings and radiators produced with Mattel Vac-U-Form or built up from soft balsa, fix to covered wing with clear dope
Tail strut
Exhaust stack position
Mainspar
1" dihedral
Gun fairing
Radiator
.030 music wire landing gear
.030 alum. tube
Rolled paper ring
1/16" sq. spokes
WHEEL CONSTRUCTION



Cut off
3/32" sq. leading edge
Front & rear prop. discs - 1mm. ply
1/16" x 1/4"
W-1
W-2
W-3
W-4
W-5
W-6
W-7
1/16" main-spar (see front view for taper)
Position of F-9
Cut off
Gun fairing
Underwing radiator
Cut three prop. blade blanks. Assemble over plan with epoxy and glue ply discs in place before carving blades.
Propeller blade blank 2 3/4" X 1/2" X 3/4"
Front ply disc
Rear ply disc
3/32" x 1/4"
1/16" sheet
Cut off
1.
WING CENTRE-SECTION
Sand underside flat.
2.
1mm. ply disc
1/8" balsa discs
Plastic tube
Clutch pin
Steel pin
Clutch engaged
·045 music wire
1.
2.
3.
Sequence of bending clutch loop - ·015 music wire - solder to shaft.



Wheel 'tyres'
F-2
Nose plug
F-3
F-4
1/8" sheet (1 off)
F-1
Nose plug
Nose plug
W-2
W-3
W-4
W-5
Exhaust stack sides
1/32" sheet (1 off)
W-2
W-3
W-4
W-5
W-6
W-6
F-11
F-12
F-8
F-7
F-5
F-5
1/16" sheet (1 off)
F-11
F-8
F-6
F-9A
F-6
F-10
F-9
F-9
F-10
F-7
MESSERSCHMITT Bf.109E.
F-12
F-9A
1/16" sheet (1 off)
Wheel center
Wheel center
K-6
K-6
K-1
K-2
K-5
Tail wheel
K-7
K-7
K-3
K-8
W-7
K-8
W-1
S-1
K-4
R-1
W-1
Tail wheel
S-2
S-1
R-2
W-7




**Sort of a "stretched" version of the FW-190, the proportions of the TA-152 are excellent for producing a flying scale model.**

# FOCKE-WULF TA-152

**By HAL COVER**

● The success of the FW-190 as a low and medium altitude fighter was well proven over England in 1941, however, the Luftwaffe soon found it needed a high altitude fighter aircraft to combat the increasing numbers of Allied bombers. Thus, work was initiated for various improvements on the basic FW-190. There were many versions built, too numerous to mention, and among them was the "D" Series 190. These, along with others, had a Junkers Jumo 213E, 12 cylinder liquid cooled engine. This basic configuration was subject to many modifications and eventually became the TA-152. The designations of all new versions of the FW-190 were changed as a result of a 1944 German Airforce policy, which named the designer in all new aircraft. Thus the FW-190 D variations were now called the TA-152, (after designer Kurt Tank).

This plane had rather impressive performance figures and was said to have handled like a sailplane at altitude. The TA-152 was not used extensively in combat, its primary assignment being to fly cover for the jet powered ME-262. Most of the approximately 150 which were in combat squadrons were destroyed by ground strafing.

The TA-152 had a wingspan of 47 feet 4-1/2 inches, length 35 feet 1-2/3 inches, height 11 feet, area 250 sq. ft., power plant Junkers Jumo 213E, maximum HP 2,050 with injection. Performance: 475 MPH at 41,000 feet, ceiling 48,550 feet (Standard FW-190A, 408 MPH and ceiling 33,800 feet).

When you look at 3-views of the TA-152, it is immediately apparent that it will make a good scale model. It has reasonable dihedral, a long nose, slim fuselage and good ground clearance for a flying propeller. The only deviations from scale on the TA-152 presented here is an increase in stabilizer area. If you take your time and construct it carefully, you will be more than rewarded when you fly it.


**With its high aspect ratio wing, the TA-152 was said to handle like a sailplane at the high altitudes for which it was designed to operate.**

## GENERAL CONSTRUCTION HINTS

1. Carefully attach the plan halves together. This can best be done by aligning the borders, using a straight edge.

2. Study and understand the plans before you cut any wood.

3. Always use a sharp knife, preferably a razor blade. This helps to avoid mashing wood and gives clean, straight cuts.

4. When cutting out bulkheads, ribs, and outlines, take your time and avoid

cutting too big a notch. Remember, once out, you can always make a notch wider, but it is rather difficult to make it narrower!

5. Place a sheet of plastic wrap over the plans where any cementing is to be performed.

6. Use a cement such as Titebond; it gives a strong joint and it has enough working time to allow you to correctly align the construction.

7. Don't go too heavy on sandpaper; use 6/0, 320 or 400, take your time, and use light pressure. Heavy pressure and coarse sandpaper can cause severe distortion of the structure. Also, the use of sanding blocks will help avoid dips and bumps.

FUSELAGE

Cut the top, bottom and side keels (items F-1 through F-7) out of medium grade 1/16 sheet. Cement the side, top, and bottom keels together over the plans and while these items are drying, cut the bulkheads out of medium 1/16 sheet. Cut the notches only where shown; mark the others and cut as required later in construction. Cement one side of bulkheads No. 3 through 12 vertically on the assembled top and bottom keel, making sure the slots for the side keel are kept straight. Next, cement in the side keel. Move any bulkheads as necessary to keep the side keel straight. When this assembly is dry, remove from the plans and attach the other half of the bulkheads No. 3 through 12, also 8A.

The 1/16 square stringers may now be attached. Start at the nose and work back. Carefully align the stringers between the bulkheads which have notches, and as required cut out the remaining notches. To avoid pulling the fuselage out of line, do not put all stringers on one side at once, but rather, alternate back and forth. The bottom four stringers will be attached after the wing is put in place. Glue 1/16 sheet between the stringers at Former 11 to provide an anchor for the 1/8 inch dowel used to hold the rubber.

The cowl front is made from four disks of 1/8 sheet. These are cemented together with the grain crossed. Make sure cowl Former 2 is in the back and that Former C fits snugly into it. The nose plug is made from Formers A, B, and C, and two hardwood thrust plugs. Various areas to be sheeted can be left until a later operation.

TAIL SURFACES

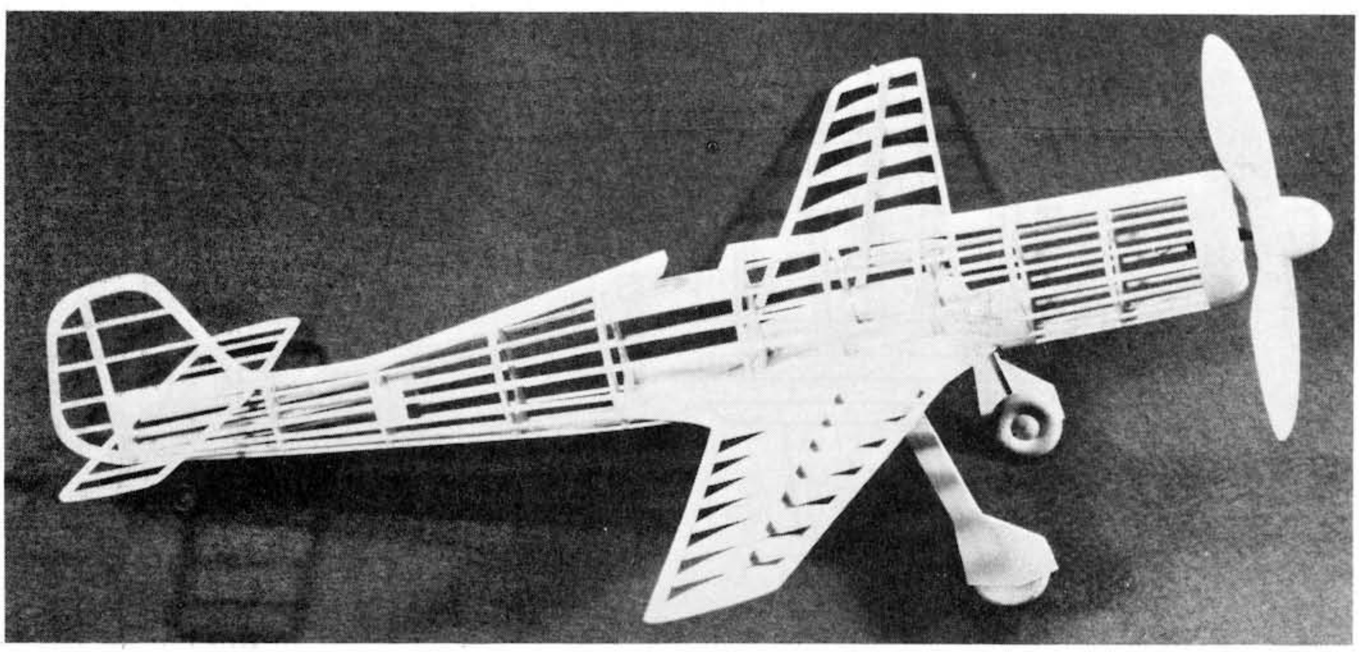
The construction of the stabilizer and rudder are conventional and simple, but it is very important to make sure all joints fit well, not filled with glue, because sloppy fits lead to warps. All outlines are cut from medium 1/16 sheet. Use hard 1/16 x 1/8 for the stabilizer leading and trailing edge and hard 1/16 square for the flat ribs.

The spar and trailing edge of the rudder are selected from hard 1/16 x 1/8 with hard 1/16 square ribs. After allowing to thoroughly dry, remove from the plans and sand lightly with a sanding block. Shape the leading and trailing edges to a streamlined shape but not knife edge.

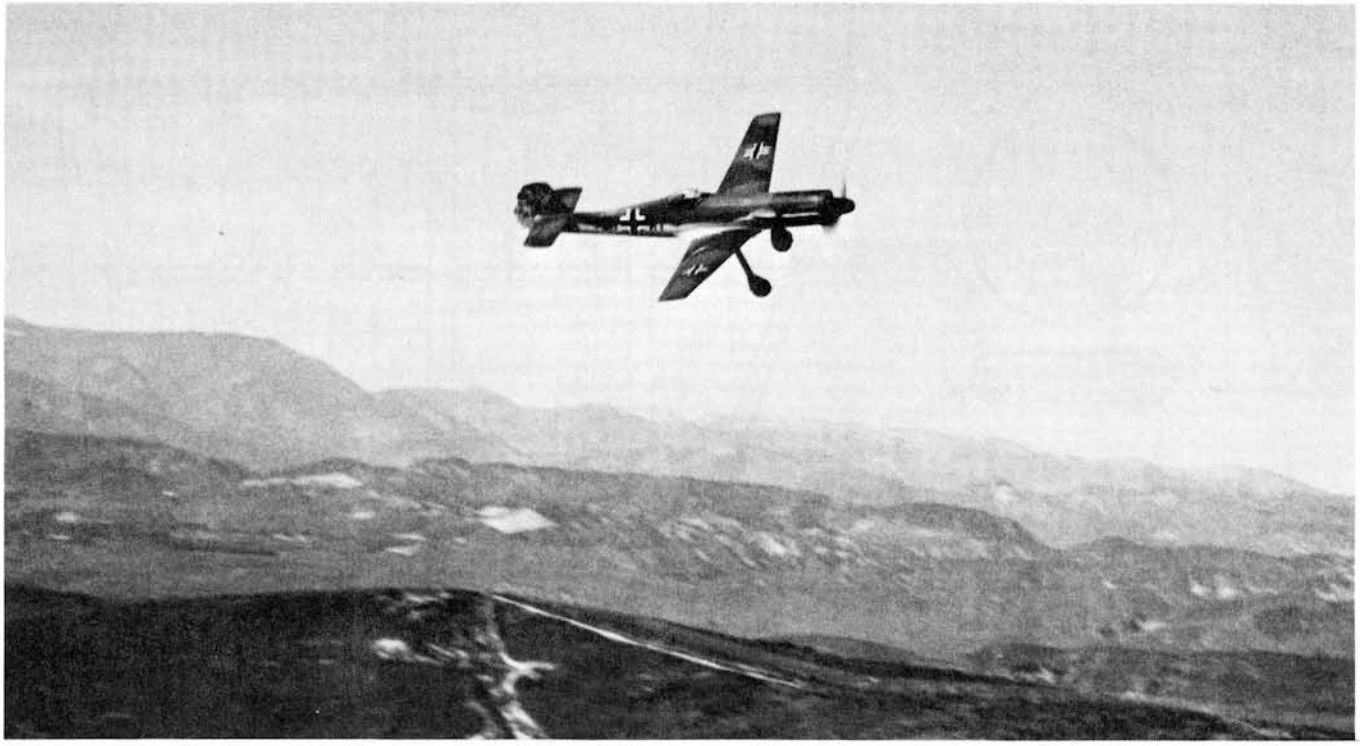
WING

The wood used in the wing construction should be strong, since the landing gear is supported by this structure. Medium grade 1/16 sheet is used for the wing ribs and tips. Hard 1/8 square is used for the landing gear spar. Other wood should be selected from straight

**With its big prop scooping up large chunks of air, Hal's TA-152 is off for another flight. The long scale landing gear permits use of a very efficient flying propeller.**



**The long nose moment of the TA eliminates the need for extra weight for balancing. Long tail moment improves stability. Rounded fuselage is a natural for half-shell construction.**



**Mountainous area west of Los Angeles, California makes an excellent background for the TA as it appears to be making a turn for its final approach to a landing.**

medium grade balsa.

Pin the leading and trailing edges and 1/8 sq. spar in place, taking care to obtain a good fit on the leading edge splice. Cement ribs No. 2 through 20 in place and add the 1/16 x 1/8 top spar. When both halves are dry, remove from the plans and add the dihedral by carefully fitting the two spars, leading, and trailing edges together, with 1-3/4 inches dihedral under each tip. Fit rib No. 1 in place and cement in the dihedral.

Sheet the wing center top with 1/32 light sheet. You will note the sheeting is flush with the spars, leading and trailing edge . . . it does not lay over them.

Sand the leading and trailing edges to the required shape and make sure there are no lumps or burrs on the surfaces.

LANDING GEAR

The landing gear used on this plane is quite strong and should present no structural problems if properly installed. Carefully bend a right and left (mirror image) gear from 1/32 piano wire. It should fit snugly over the 1/8 square, along the rib and through the rib and against the upper wing spar. A hard 1/16 sheet fillet is added to the bottom of the wing, which helps trap the wire. It is recommended that regular model glue be used for the gear attachment, using several light coats rather than one or two heavy coats.

The wheels are laminated cross grain out of medium 1/8 sheet. Cement washers on both sides of each wheel so they turn freely and accurately. Then sand the wheel to the shape shown.

PROPELLER

A six or seven inch Kaysun propeller may be used if desired. Or if you want to carve your own, select a hard balsa block 6-1/2 x 1-3/8 x 7/8, and drill the propeller shaft hole prior to cutting out the basic outline. Carve and finish the back side of the propeller first. Then carve the front until you have a 1/16 to 3/32 thick blade. (Did you carve a right hand prop? - - That's what it should be!)

The prop shaft is formed from 1/32 piano wire. Slip the nose plug, which was assembled previously, 2 washers, and the propeller on the shaft, then bend the wire as shown on the plans and press into the prop. Coat with several light coats of cement.

The spinner is carved from a 1 x 1 x 1-1/4 block. To get proper alignment, it is best to tack it on the prop, hook a short motor onto the shaft and wind in a few turns, eyeball align the spinner as the prop unwinds. When satisfactorally aligned, glue permanently in place.

ASSEMBLY AND COVERING

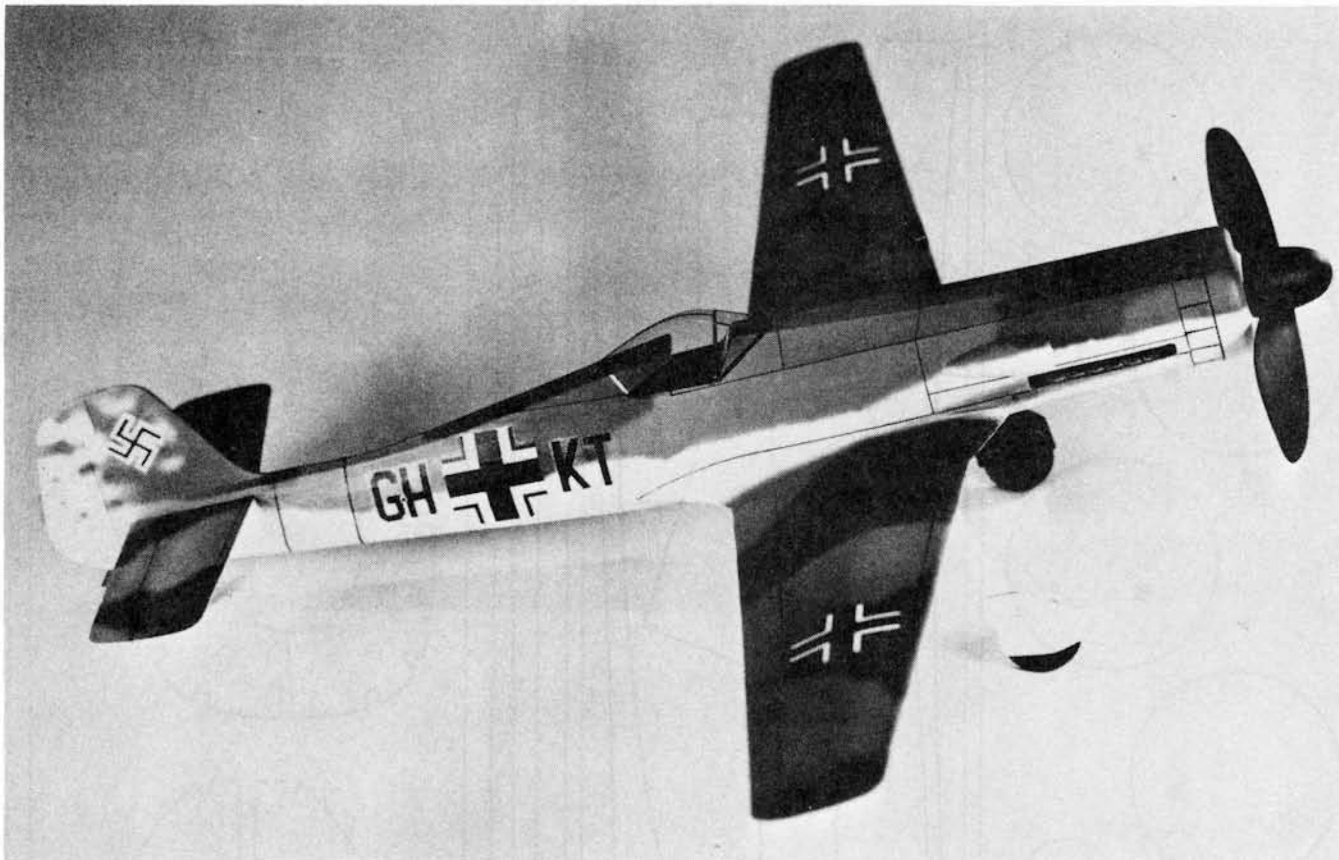
Secure the wing to the fuselage, taking care that it is properly aligned. Do not attach the stab and rudder until later. Add fillet F8 to each side and then the remaining four bottom stringers. Cement in place the 1/32 sheeting in front of the wing and in the cockpit area. Next, the large 1/32 sheet wing fillet is added. This operation is best done by soaking the pieces in water. Cement between the stringers and against Bulkhead 9, and bend out to follow the contour of Former F-8. It is best to feather edge this area so it blends evenly into the wing and fuselage. The narrow front half is positioned at a 45° angle to the wing and runs forward to the leading edge. The best method of keeping this fairing in place while it is drying is to find a comfortable chair, sit down and *hold* it in place.

Sand the entire structure carefully. Since only those members of the fuselage which run from the nose to tail should touch the covering it is best to sand the bulkheads to a scalloped shape (Note the framework pictures). This can be done with a dowel or other object with fine sandpaper wrapped around it.

Apply a light coat of sanding sealer to all surfaces which will touch the covering, sand lightly and apply a second coat. When you are sure all surfaces are smooth, you are ready to cover. The tail surfaces are first. Apply a coat of thinned dope to the outline of the surface and stretch the tissue over the frame. Gently rub the tissue against the doped areas as you pull out the tissue. When dry, trim and dope down the loose edges. Both sides are done in the same manner.

The author found it easiest to cover the fuselage with full length strips of tissue slightly wider than the space between adjacent stringers. This may sound tedious, but by cutting the tissue with a straight edge you will find it will lay along one stringer, and when the dope is dry, all you have to do is trim off the exposed side. Repeat a strip at a time around the fuselage. Cover the wing in a similar manner to the tail surfaces. A separate piece of tissue will be needed to cover the top of the tip.

Slide the stab in place, align, and glue to both the top and bottom stringers. Attach the rudder. When all glue is dry, carefully check that all tissue is attached




**Only deviation from scale to improve flight performance was enlargement of the stabilizer. Long fuselage permits a substantial amount of rubber for long powered flights. Watch out for those thermals, you may lose it!**

and not just laying in place. Lightly water spray the entire structure. Allow to dry at room temperature, don't force the drying with heat. While the structure is drying, the landing gear doors are covered with tissue and cemented to the landing gear with several thin coats of cement.

Apply one light coat of dope (50/50 dope and thinner). If you do not plan on painting the plane, add tissue trim as required and add one more coat of dope.

It is recommended, if you want to paint a scale type paint job, that you use a good air brush. This allows the use of a minimum amount of paint without adding significant weight. (The author's plane, with paint and rubber, weighed 1.4 ounces). The colors used were flat aero blue on the bottom with flat olive drab and artillery olive for the top camouflage effect. Paint the inside of the cowl, the nose plug, prop and spinner flat black.

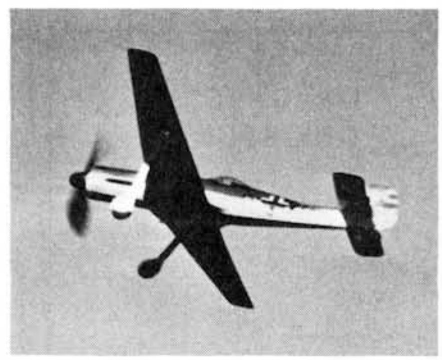
Add control surface lines and any other desired lines using a lettering pen and India ink. Be sure, after the lines are dry, to lightly spray with clear flat, otherwise the lines would come off with water.

The cockpit is then cemented in place, carefully, using regular model cement. Other numerous details are added at this point. The exhaust stacks, painted black or brown, are glued to the sides as shown in pictures. Paint the wheels black prior to placing them on the axles. The wheels are held in place with a washer soldered or glued to the end of the axle. Additional details can be added by checking photos and 3-views of the real plane. (See scale references below)

FLYING

Four strands of 1/8 inch rubber will be needed to power the model. Make a fork out of 1/8 x 3/8 by cutting a notch in one end which is bigger than the rear dowel. Loop the rubber over the fork and slip into the fuselage. When you can see the opening of the fork through the dowel hole, slip the dowel in place and pull out the fork. Hook the other end of the rubber to the prop. Now balance the plane 1/8 inch back from the leading edge at the tips.

If possible, test the model over tall grass while preliminary adjustments are being made. Initial adjustments should be made in the glide by moving the balance point forward if it stalls and backward if it dives. If any major change is necessary, you probably have bad warps and they should be removed by steaming over a tea kettle. Down-thrust and side thrust should be added as necessary to obtain a large left hand circle under power. The glide can be right or left. For maximum winds, the motor may be wound using a winder. This is done by removing the prop assembly, hooking the motor to the winder, stretching the motor two to three



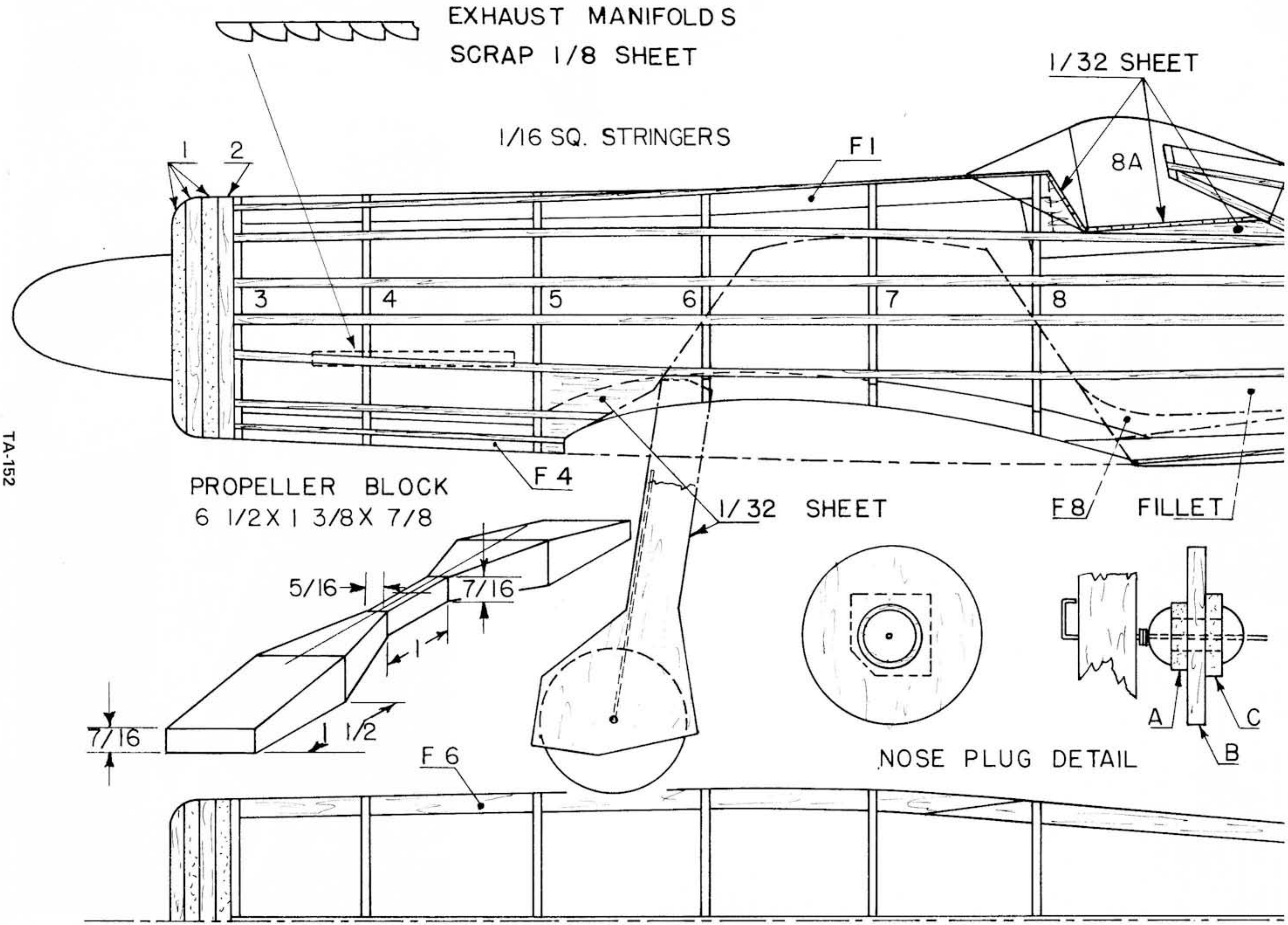
times its slack length, and winding. It is best to test a motor outside the plane so you know how many turns it will take. After you get your Focke-Wulf flying, you'll want to put on your hob nail boots and click your heels as it flys overhead!

REFERENCES

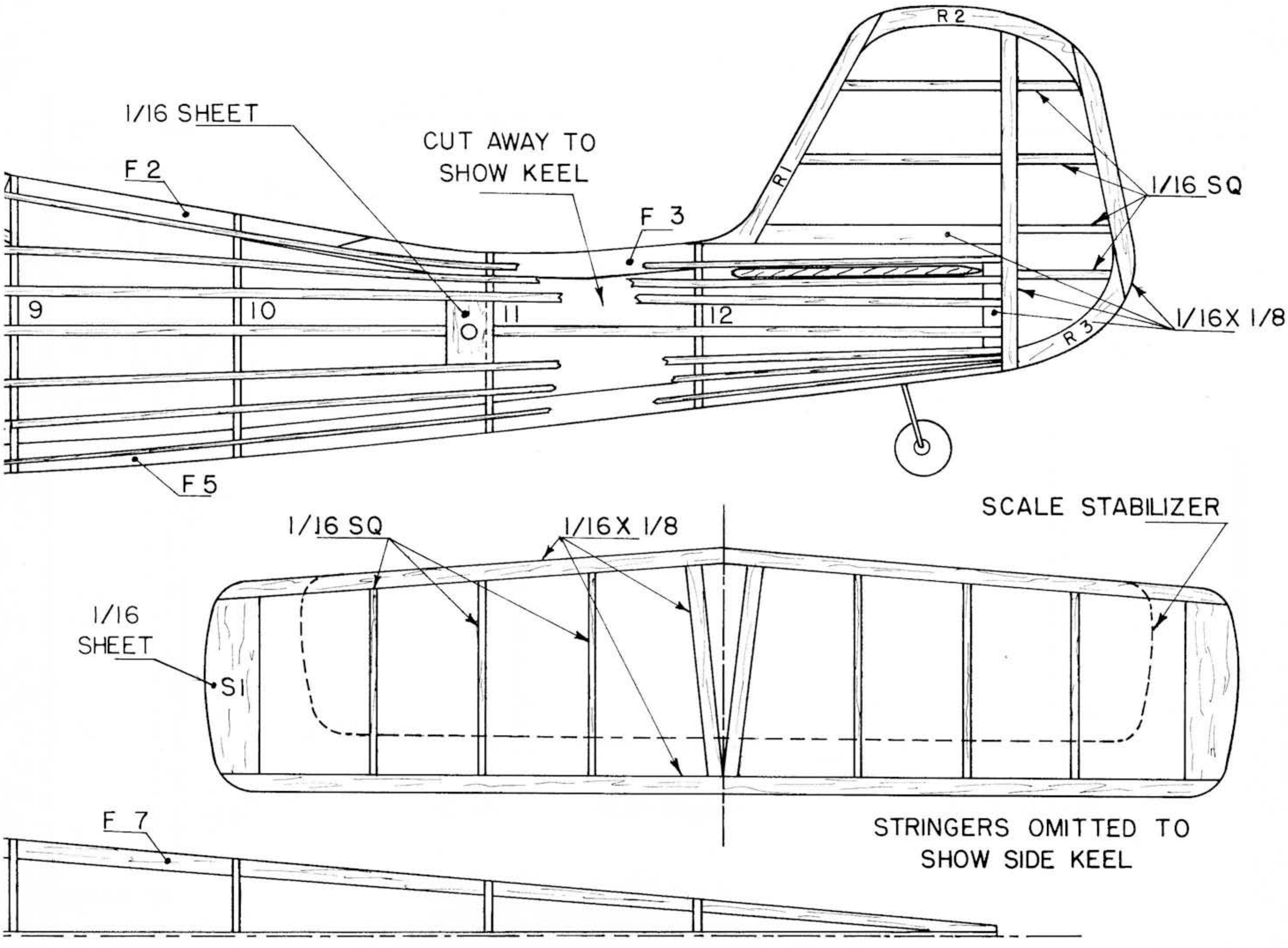
"War Planes of the Third Reich," William Green, Doubleday & Company. Library of Congress No. 88-29673.

Profile No. 94, Focke-Wulf FW 190/TA–152 Series. Profile Publications limited, Coburg House Sheet Street, Windson, Berkshire, England.

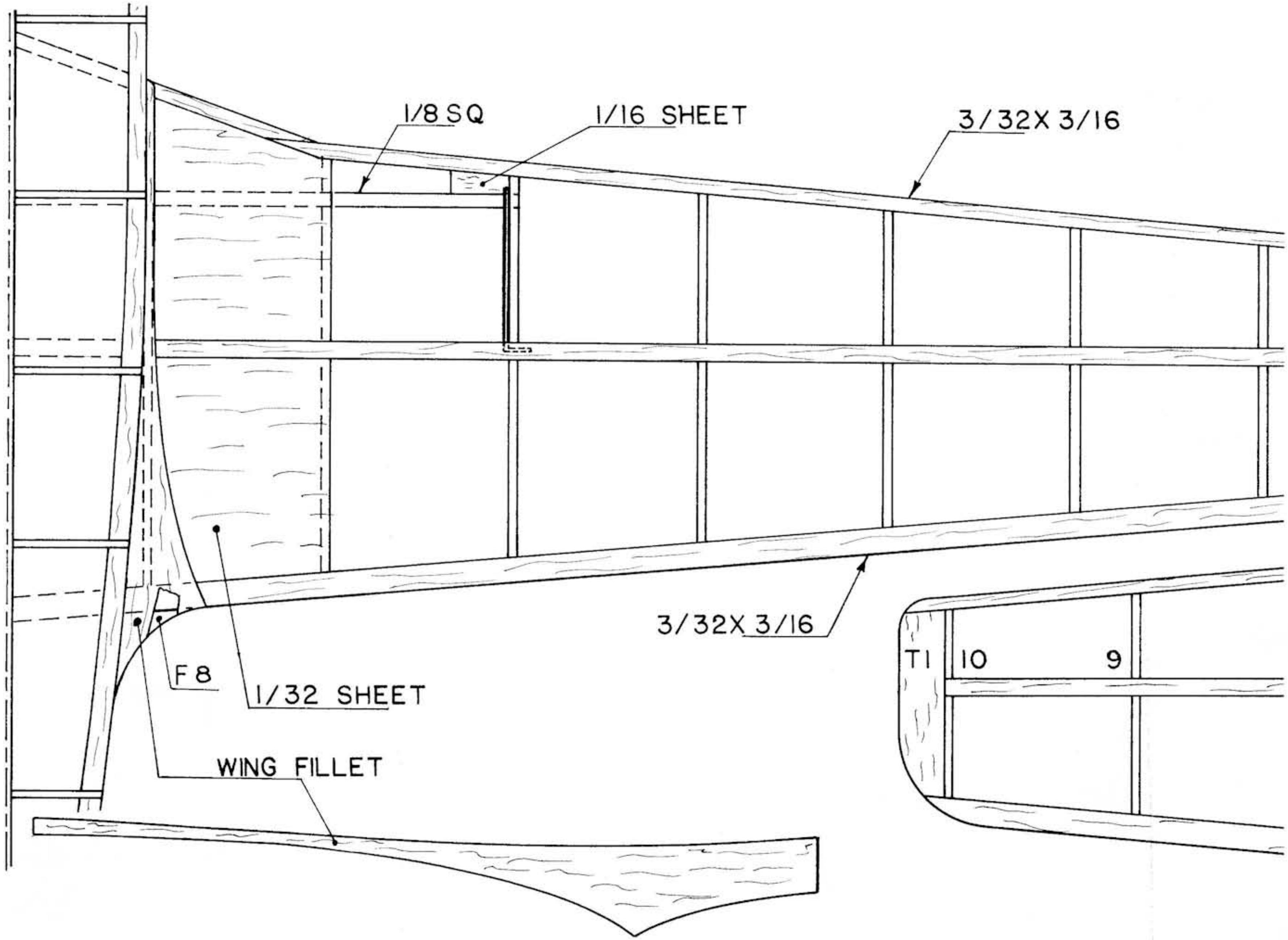
"Focke-Wulf 190 & TA–152 Series 1," No. 9 Technical Manual. Published by Kookaburra Technical Publications, Australia. North American Distributor, J.W.C. Publications, Sun Valley, California. ●

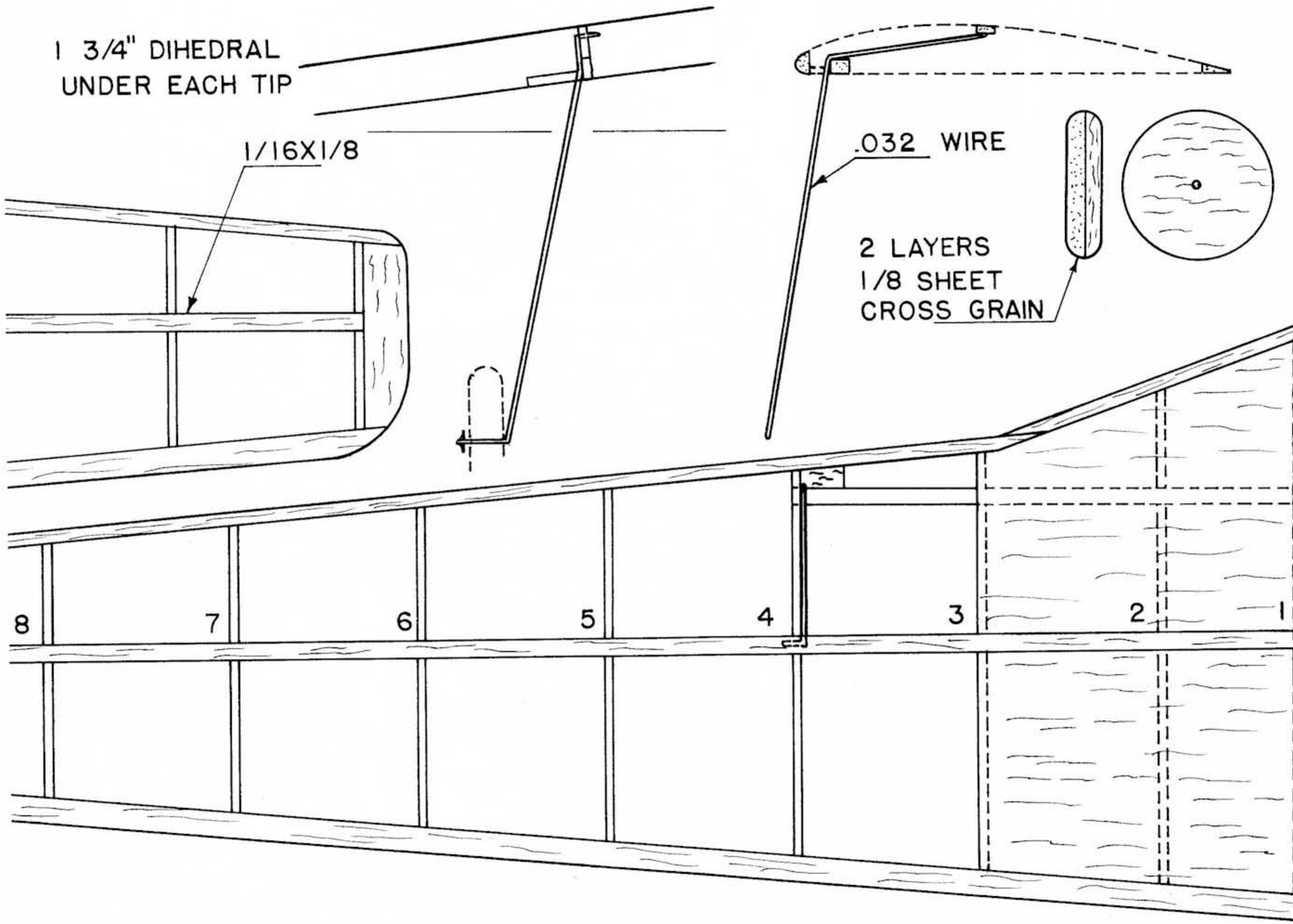

EXHAUST MANIFOLDS
SCRAP 1/8 SHEET
1/32 SHEET
1/16 SQ. STRINGERS
F1
8A
1
2
3
4
5
6
7
8
F4
PROPELLER BLOCK
6 1/2 X 1 3/8 X 7/8
1/32 SHEET
F8
FILLET
5/16
7/16
1
1 1/2
7/16
F6
NOSE PLUG DETAIL
A
B
C

TA-152

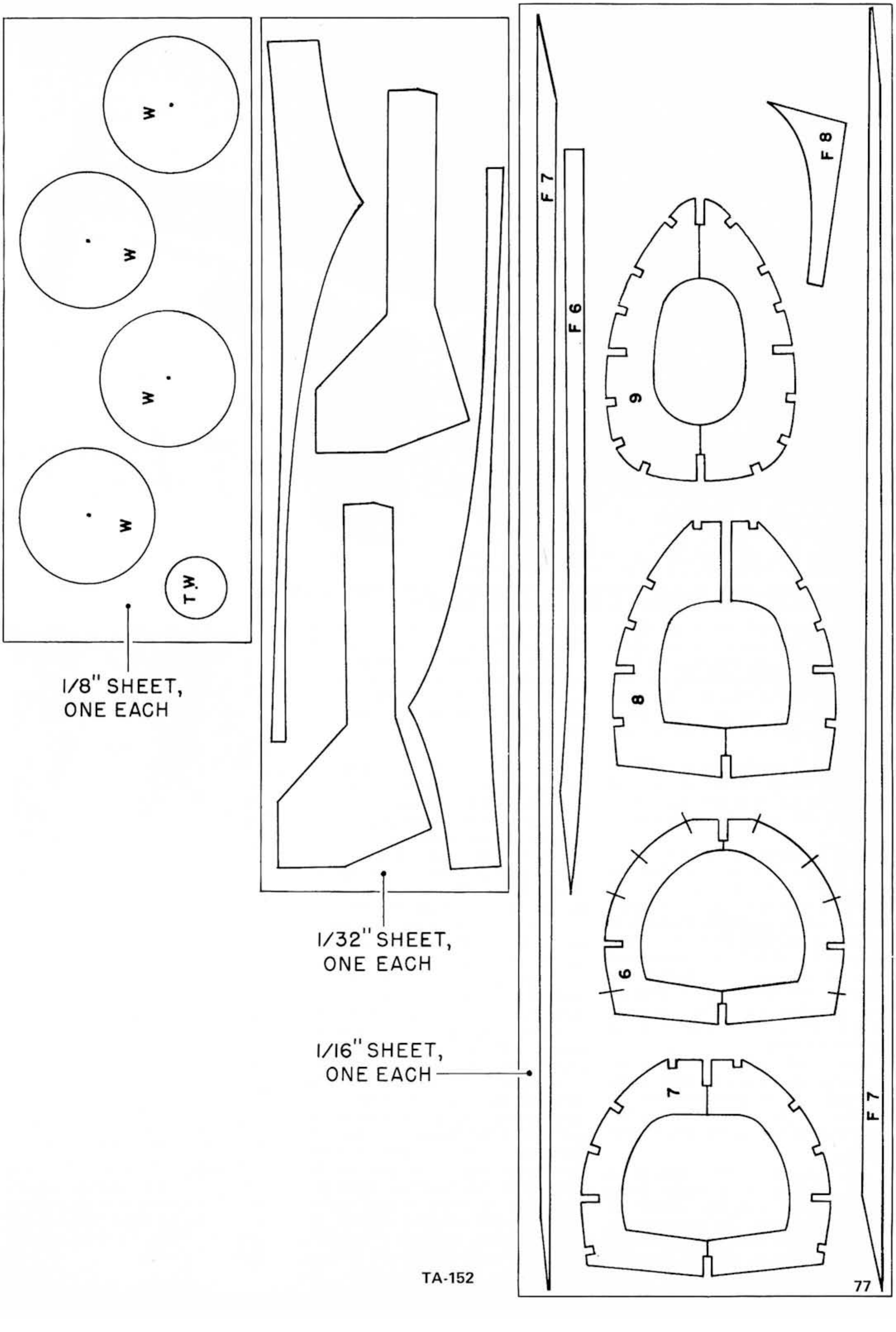


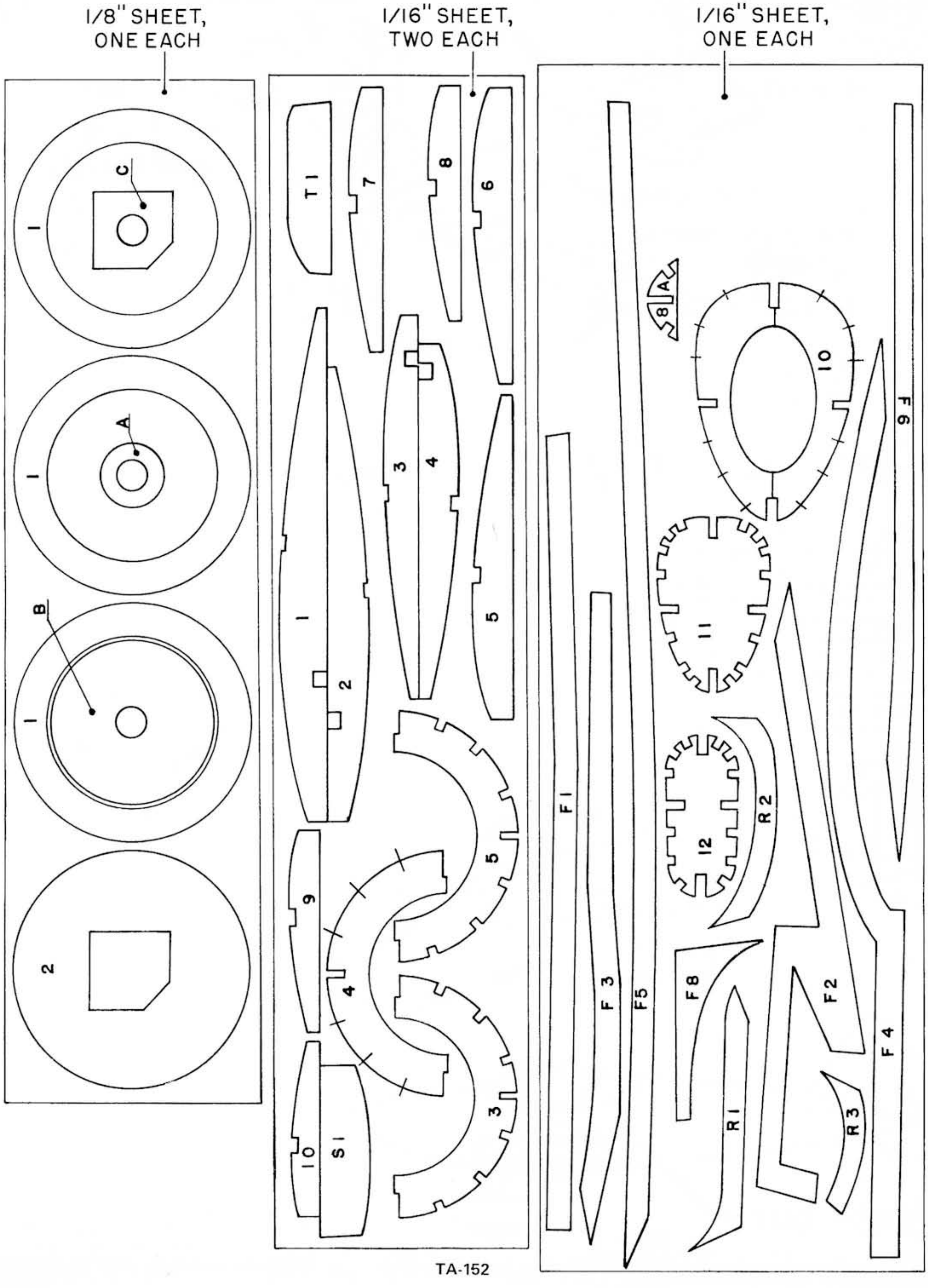
1/16 SHEET
CUT AWAY TO SHOW KEEL
F 2
F 3
R 2
R 1
R 3
1/16 SQ
1/16 X 1/8
9
10
11
12
F 5
SCALE STABILIZER
1/16 SQ
1/16 X 1/8
1/16 SHEET
S1
STRINGERS OMITTED TO SHOW SIDE KEEL
F 7


1/8 SQ
1/16 SHEET
3/32X 3/16
3/32X 3/16
F8
1/32 SHEET
WING FILLET
T1
10
9



1 3/4" DIHEDRAL
UNDER EACH TIP
1/16X1/8
.032 WIRE
2 LAYERS
1/8 SHEET
CROSS GRAIN
8
7
6
5
4
3
2
1


W
W
W
W
T.W.
1/8" SHEET, ONE EACH
1/32" SHEET, ONE EACH
F 7
F 6
F 8
9
8
6
7
F 7
1/16" SHEET, ONE EACH


1/8" SHEET, ONE EACH
1/16" SHEET, TWO EACH
1/16" SHEET, ONE EACH
C
A
B
1
1
1
2
T1
7
8
6
1
2
3
4
5
9
10
S1
5
4
3
F1
F3
F5
8
A
10
11
12
R2
F6
F8
F2
F4
R1
R3

TA-152

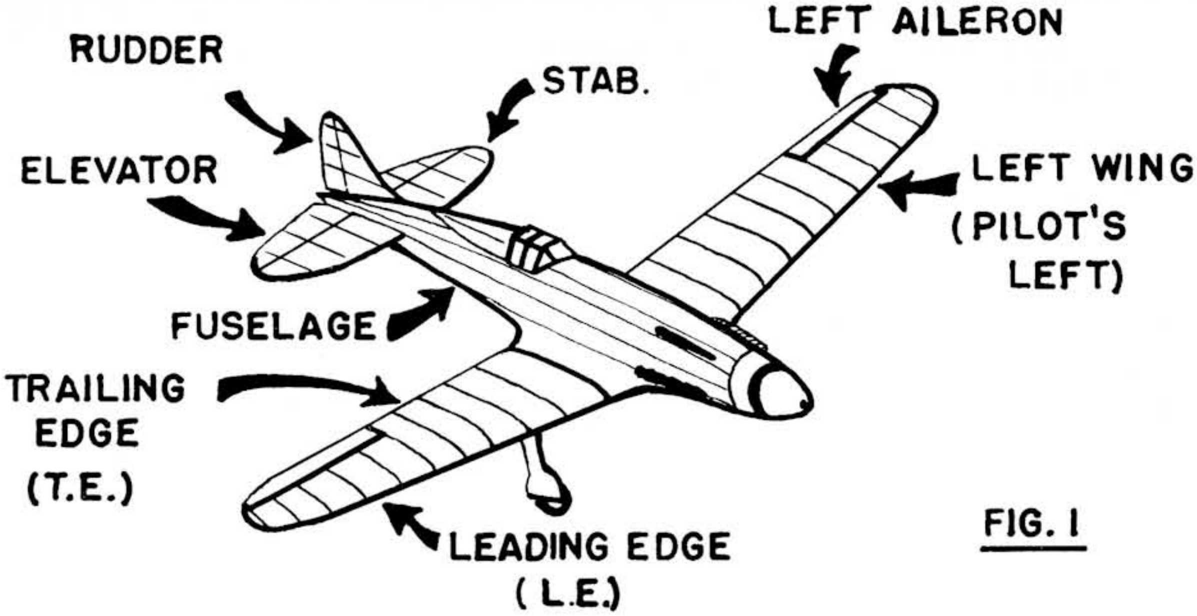



FIG. 1

# Making It Fly

By BILL WARNER

● The challenge of the third dimension! Due to the fact that model aeroplanes do their thing in a fluid substance and can (and do) move in any direction, the problem of making them do what you wish them to is a challenging and rewarding one! Many factors are operating at the same time, and learning to sort them all out takes patience and practice. Rather than destroy your recently-completed stick-and-tissue beauty, why not spend a while practicing some of the following advice with an inexpensive R.O.G. rubber job of the "Sleek Streek" variety? No better way to learn the effects of moving rudder and elevator, warping wings (aileron effect) and adding weight, such as modeling clay or plasticine, to the nose, tail, or wingtips!

When you get ready to fly your own handiwork, you can increase your chances of success by keeping several things in mind while you are building.

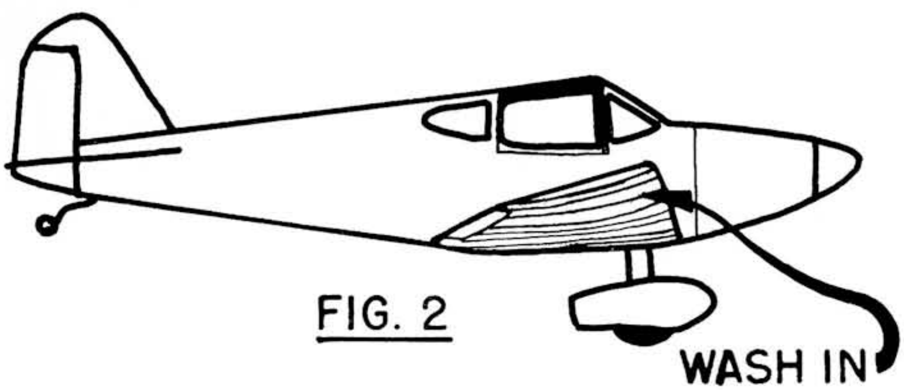



FIG. 2

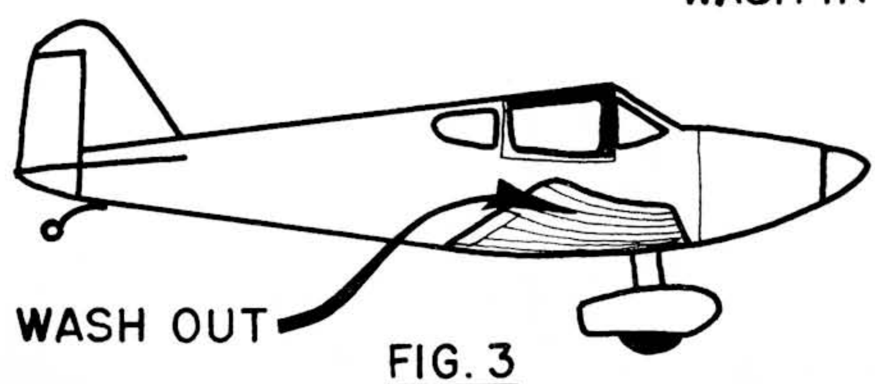



FIG. 3

To begin with, remember that the magic word is LIGHTNESS! A 12 inch rubber scale model which weighs 4 grams can turn in flights of several minutes in thermal air, but one that weighs 6 grams may never see the other side of thirty seconds. Light models do not crash as hard, so get damaged less in the all-important early testing period. Build strength into the nose, as that's "crash central," and usually needs to have weight added anyway. Make a strong landing gear, with thin music wire embedded in balsa wood for larger models. Save weight in the tail, wing tips, and in parts which are non load-carrying.

No. 1 in importance next to lightness is adjustability. Darn few models will fly without adjustments, and the easier they are to make, the better! Having separated ailerons, rudder, elevators, attached with thin, bendable (not weak, however) wire helps. A must is a snug-fitting removable nose block which fits into a hole that has been made large enough to let a fully stretch-wound rubber motor back into the fuselage. It is also essential in making thrust adjustments for good power-on flight.

Finally, the model must be built "straight." Wings, stab, and rudder should be flat, without twists. Viewed from the top, one wing tip should be no further forward than the other. As seen from the rear, the stab should not be tilted in relation to the wing. The rudder must be flat. To keep out flight-destroying warps, be sure to use a plasticiser in your dope. Keeping away from colored dope saves weight, and about two coats of clear dope mixed 50/50 with thinner plasticised by a few

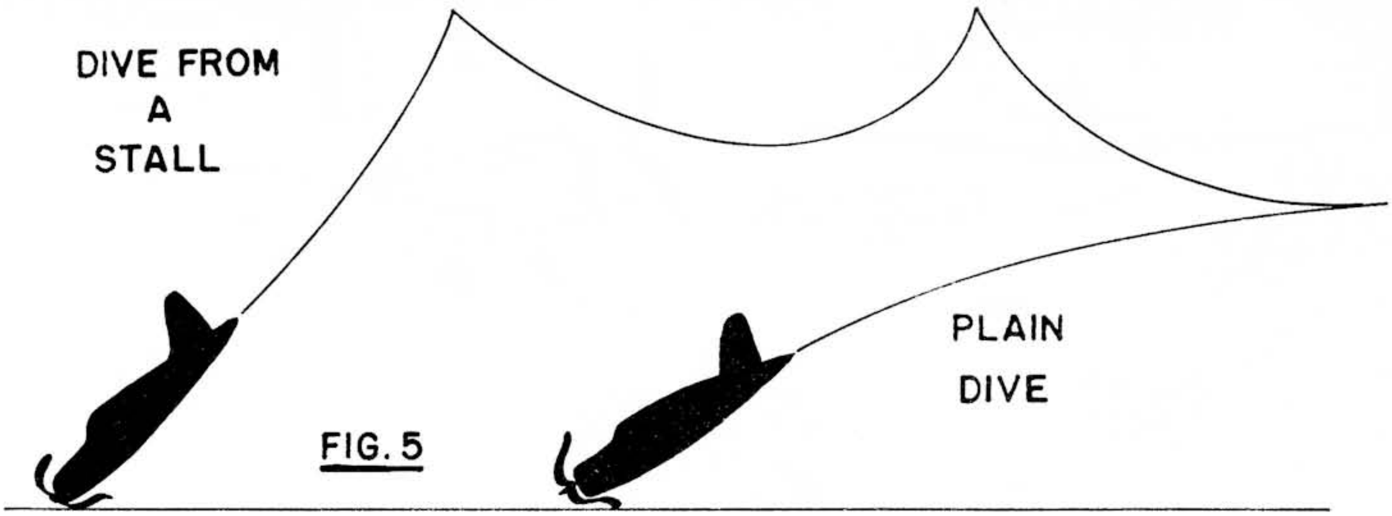



FIG. 5

drops of castor oil or tri-cresyl phosphate (T.C.P.) per ounce should do nicely.

A pre-flight check list may help you get ready for the big moment with a minimum of problems:

1. Sight under wing and stab, from front and from back to check for warps. A little "wash-in" in the left wing is O.K. to help keep this wing up in a left hand power pattern. The stab should be *absolutely* flat. Twist surface in opposite direction over heat to remove warps. Wash-out in both tips is a good idea for low wing or low dihedral models. (Fig. 2, 3)
2. Check rudder for twist. Bend rear of rudder just slightly (1/32 or less) to induce left turn.
3. Balance plane at about 35% of chord, that is, the plane should balance "teeter-totter" fashion about 1/3 of the way back from the leading edge of the wing. Add clay to nose if necessary. (Fig. 4)
4. Make up a few rubber motors of varying lengths (avg. about half again as long as the distance between the rear motor peg and the

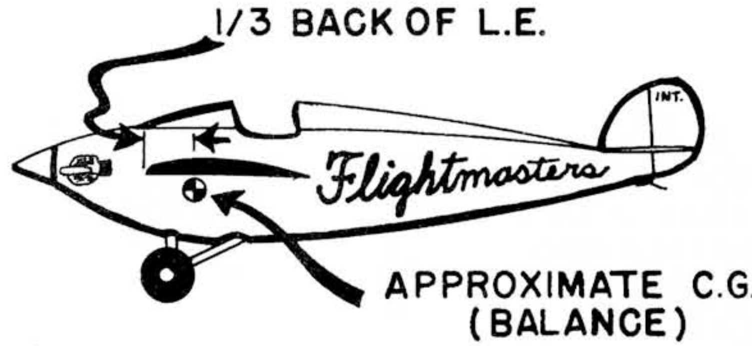



FIG. 4

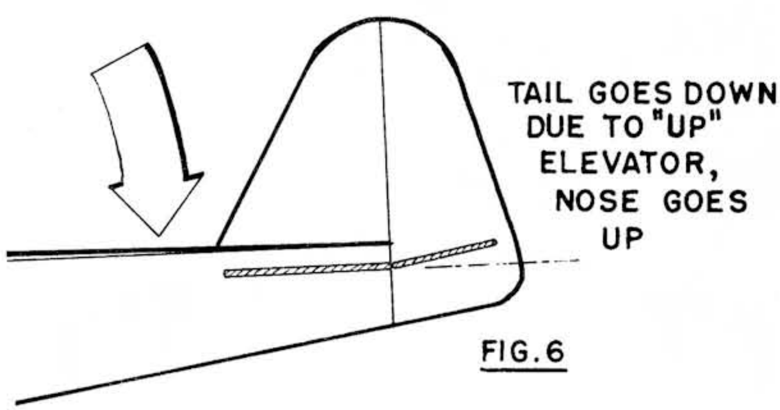



FIG. 6

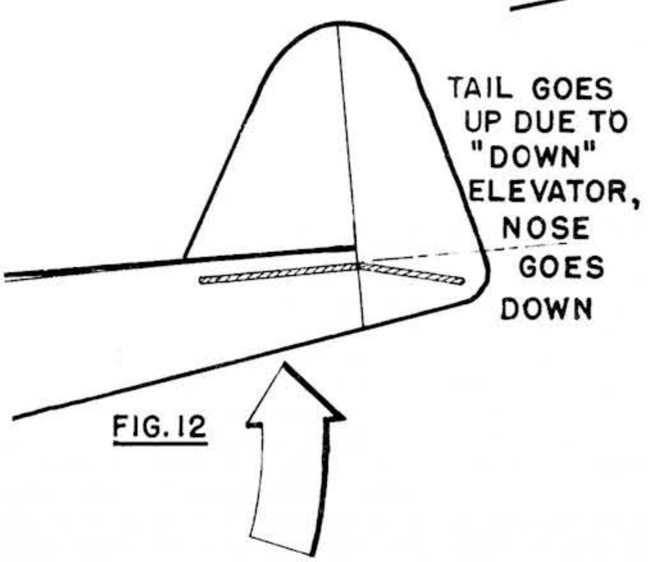



FIG. 12

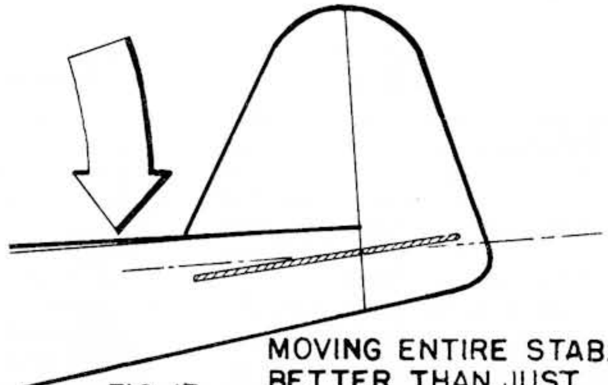



FIG. 13

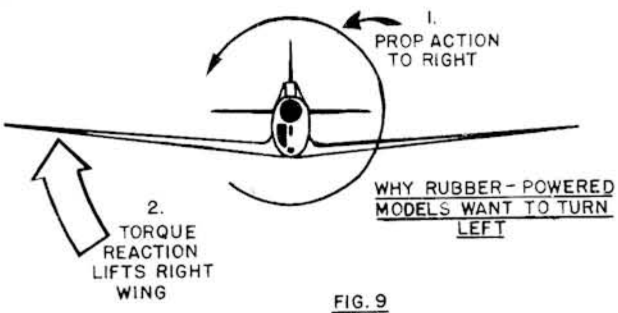



FIG. 9

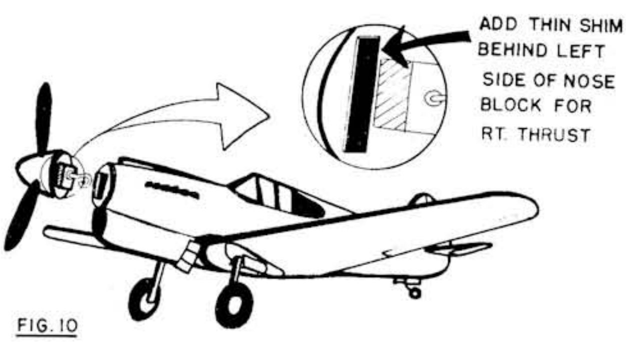



FIG. 10

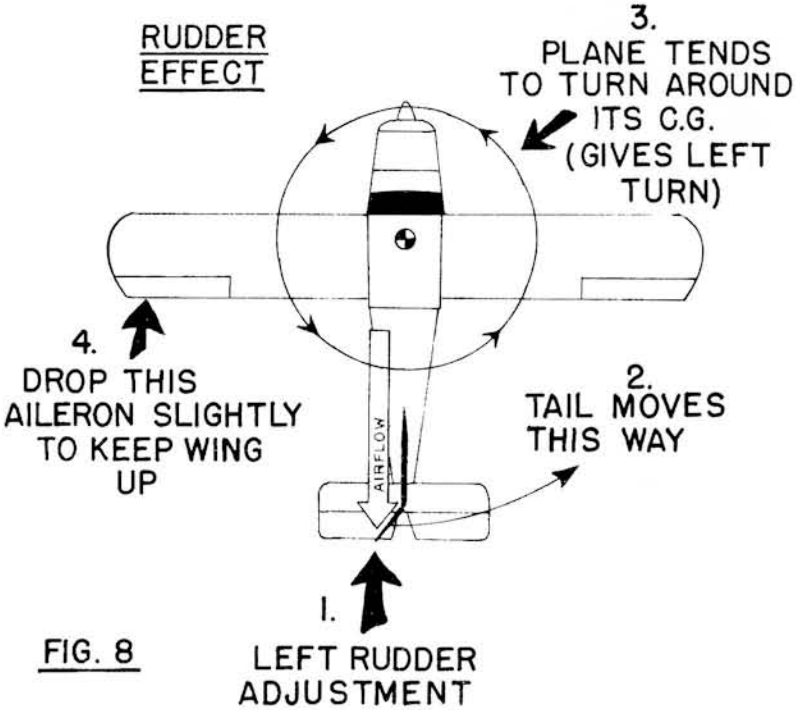



FIG. 8

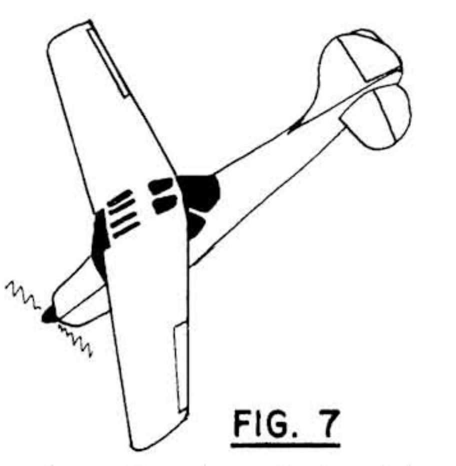


FIG. 7

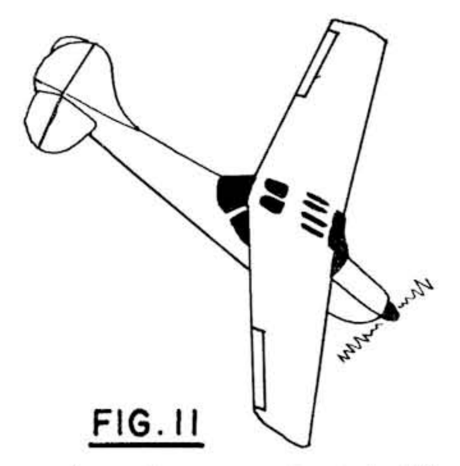


FIG. 11

prop hook) and rub some glycerin, green soap, or a mixture of the two into the rubber (Tie the knot first!). Stuff the longest one into your plane, oil the prop shaft and thrust bearing (or bead).

5. Load the following into a box and let's go: extra rubber, rubber lube, a knife, quick-dry cement or 5-minute epoxy, modeling clay, a book of matches (for shim stock), and a few scraps of balsa and tissue. Extra props of different sizes with prop shaft wire and long nose bending pliers are optional. Don't forget your rubber winder (16:1 hobby shop winder or a hand drill fixed up with a bent nail, head behind chuck jaws).
6. Caution: It's a good idea to keep your model safely in a box with a cover when not flying it. More models are damaged in transit than in flying!

The ideal flying site is a flat, treeless, grassy plain with a dead calm air condition (except for a few nice thermals rising straight up to stretch those flights!). If you ever find a place like that, let me know and I'll join you. Some sort of cushiony surface will, however, lengthen the life of your plane on the test hops, and wind is bad news for scale jobs, especially untested ones.

With a friend tenderly but firmly holding the model, stretch the motor out about two to three times its normal length through the front of the fuselage and commence winding. Just a few winds for the first hops, gradually working up to maximum, is the best policy. High power makes for high-speed crashes on untested ships.

The flight of a rubber model consists of two phases, the *powered climb-out* and the *glide*. The object of the first few flights will be to get the plane high enough to observe the glide and to adjust the model so that it makes a slow floating descent in a large circle. Once the glide is O.K., then the powered portion of the flight can be perfected by shimming the nose plug to change the thrust line angle. A perfect flight can be obtained by flying a right or left circle, but I find that turning left is safer. A bit of left rudder and a washed-in left wing will take care of torque under high power, while the glide circle will open up once the torque diminishes. Flying to the right, you are fighting torque; the power circle being held wide under power and tightening up on glide, sometimes to the point of a spiral dive. Still, many successful rubber fliers prefer the right turn due to its steeper climb, and you may wish to use it.

Your observation of what happens on each flight is very important. You must *know* which direction your model was turning when it crashed. You must *know* whether that dive was an "all-the-way-from-launch" one or whether it resulted from an extreme "nose up" launch and stall (Fig. 5). You may even want to keep a notebook of observations and adjustments tried, on a flight-by-flight basis.

Never re-fly a bad flight! Make a change before the next one and note the results. As flights improve, you may wish to add more winds, a heavier or shorter rubber motor for more power, or experiment with prop sizes (Use the largest you can get away with.).

# TROUBLE SHOOTING CHART

| SYMPTOM | POSSIBLE CAUSE | SUGGESTED REMEDIES |
|---|---|---|
| 1. Model dives in straightaway (plain dive) Fig. 5 | Nose heavy | Remove some nose weight or worse (ugh!), add weight to tail. |
| | "Down" elevator | Bend elevator or rear of stab up a tiny bit. (Fig. 6, Fig. 13). |
| 2. Model dives in, spiralling left. Fig. 7 | Too much left rudder adjustment (Fig. 8) | Bend rear of rudder slightly right. |
| | Torque reaction (Fig. 9) | Reduce power, use smaller prop, wash-in left wing, or use down on left aileron. |
| | Left thrust | Add thickness of matchbook cover, or match, behind left side of nose block to get more right thrust (Fig. 10). |
| | Nose heavy or down elevator | Lighten nose or up elevator. |
| | Warped wing(s) or stab | De-warp by twisting in opposite direction using moist, warm breath or car exhaust to help. |
| 3. Model dives in, spiralling right. (Fig. 11) | Same as for left spiral except for torque * | Left rudder, drop right aileron or wash-in right wing, add left thrust, lighten nose, up elevator, unwarp wings and stab, add power, bigger prop. (One thing at a time, though!) |
| 4. Stall or "roller coaster" effect. (Fig. 5) | Tail heavy | Add weight to nose or lighten tail. |
| | Too much "up thrust" | Add thin matchbook cover or match shim behind top of the nose plug to point prop shaft down a bit. |
| | No turn under power | Get plane turning (left) by adding either rudder to left or left thrust to nose block. (If glide is OK, leave rudder alone and use thrust only.) |
| | Too much "up" elevator. | Bend elevator or rear of stab down. (Fig. 12) |
| | You threw it on launch! | Easy does it! |
| | Windy | Wait for calm or run downwind, launch back over your shoulder (Who said modelers aren't crazy!?). |
| 5. Model flies too fast. Runs out winds in a few seconds. | Motor too strong | Use lighter rubber. |
| | Motor too short | Use longer loop (recheck C.G. location when installed). |
| | Prop too small | Use larger one. |
| 6. Model lacks power to climb. Lands with lots of winds left. | Motor too weak | Use heavier rubber or, if motor has been wound repeatedly to maximum, let it rest for 15-20 min. |
| | Motor too long | Try a shorter loop (re check C.G. location when installed). |
| | Prop too large | Try a smaller one. |
| 7. Model refuses to fly a left circle even after much work. | Design or construction quirk? | Why fight it? Try flying right! Try a bit of clay on a wing tip to help turn. |
| 8. Model refuses to fly and gets you furious at it! | Did you overlook any of the above? Maybe it's just hexed! | If you're really furious, stomp your model, it's a great emotional release. Or, if any shimming matches are left . . . The next one will probably fly right off the board! If you have enough patience left, read the "If all else fails!" section. |

*Note: Spiral propwash, or the twisting corkscrew of air coming back from the prop of a tractor model, imparts a right-hand counter-force to torque. The effect of spiral propwash varies with the configuration of the subject aircraft, and in many cases not only overcomes torque during the initial power burst, but may produce a disastrous right hand turn, lessening as the power runs down.

## CHECKING INCIDENCE WITH INCLINOMETER

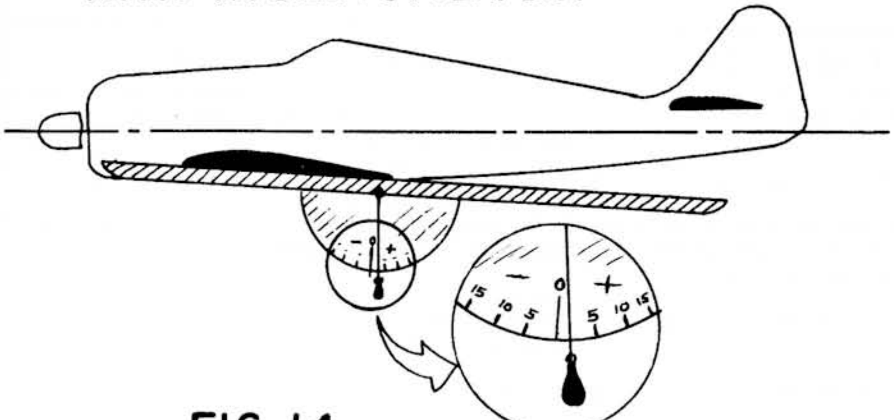
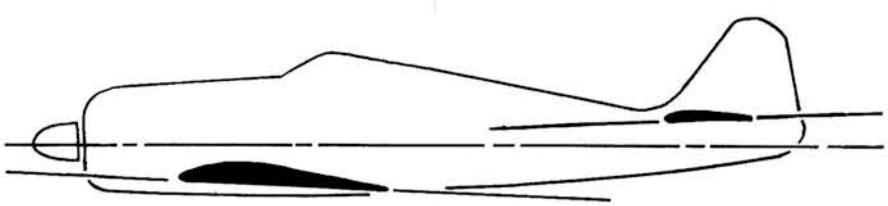



FIG. 14

## AVERAGE INCIDENCE ANGLES



| | WING | STAB |
|---|---|---|
| PARASOL | + 5° | + 2° |
| HIGH WING | + 3° | 0° |
| ——-—— THRUST LINE ——-—— | | |
| (MID-WING) | + 2° | − 1° |
| LOW WING | + 2.5° | − 1° |

FIG. 15

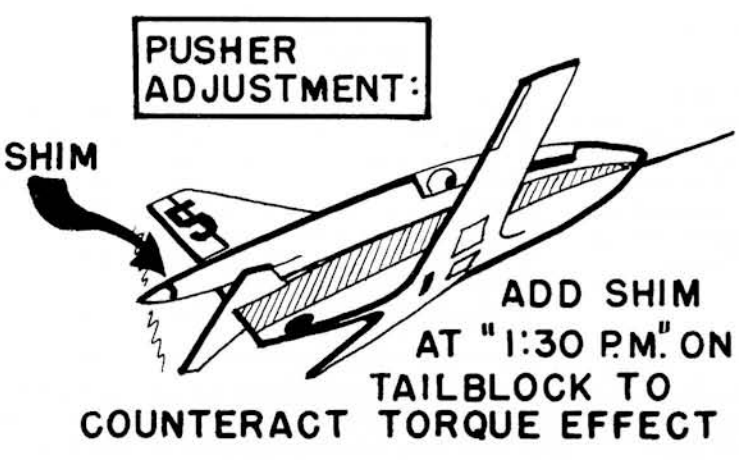



FIG. 16

IF ALL ELSE FAILS

Major adjustments may be in order if remedies in the trouble-shooting chart fail. Should you have repeated problems in the stall/dive area with great changes in the C.G. necessary to get any kind of result, you might check your incidence angles, that is the relationship of the wing and stab to the aeroplane. Generally, the leading edge of the wing is set higher than the trailing edge (positive incidence), while the trailing edge of the stab is set higher than its leading edge (negative incidence). This can be checked by blocking the fuselage up level and using an inclinometer (protractor glued to a straight stick with a weight hanging from a string). If the difference between the wing angle and the stab angle is only a degree or two, one or the other should be reglued. Having plus 3 or 4 degrees for a wing, and minus 1 or 2 degrees for a stab is a good starting place (varies with aerofoil types, area differences, distance of stab back from wing, etc.) (See Fig. 15). Note: Biplanes need about 2° more positive incidence in the top wing than in the bottom one.

Another problem in a side-to-side direction is excess dihedral, (the "vee" of the wings as seen from head-on) which may result in the model "wagging its tail" and needing a larger rudder for correction . . . or perhaps not enough dihedral which would allow the plane to sideslip when hit by a gust, diving and not pulling back level (cut down on rudder size or add dihedral angle).

Weighing your ship may also be revealing. A Peanut Scale ship should weigh about 5 grams (1/3 oz. maximum) for a 13 inch span. An 18 inch span ship might weigh about 18 grams (1-1/4 oz.) and a 36 inch span model about 86 grams (3 oz.). How heavy is "too heavy" depends on a lot of things, including wing area, drag, airfoil, etc., but if your model comes out double or triple these weights, part of your adjustment problem may stem from having to fly fast to generate enough lift to stay in the air. Of course, the faster you have to fly, the more "effective" little warps and misalignments become, and the more headaches they will give you. You will notice that lightness becomes increasingly important as the model size decreases. You can lighten your model at this stage by perhaps making balsa wheels, or you can make a new, perhaps larger stab, with a slightly curved top (lifting) surface out of lighter wood, which will allow you to remove some of the nose balance weight . . . if you added any.

Last, but not least, don't hesitate to ask for help from experienced fliers in trimming your ship . . . if you can locate any near you. People who fly rubber are the greatest, and they'll bend over backwards to give you a hand, even if they're competing against you in a contest! ●

The author's Airacobra has put in many one-minute-plus flights. The long nose moment simplifies proper balancing, and the trike gear makes takeoffs pure pleasure.

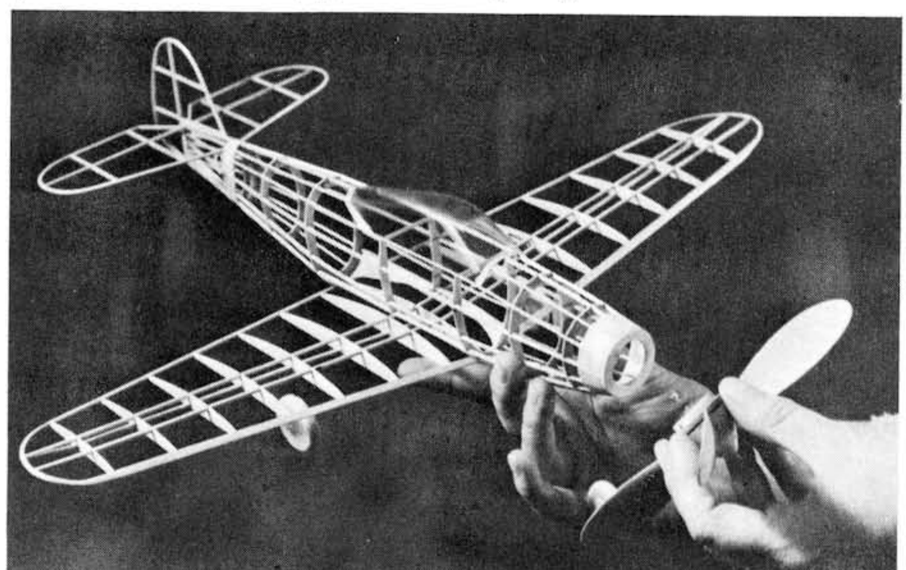
# BELL P-39 AIRACOBRA By CLARENCE MATHER

● The sleek lines and graceful proportions of the P-39 made it a beautiful aircraft! Designer Lawrence Bell showed refreshing originality in locating the engine over the wing and driving the propeller by an extension shaft. That location permitted a number of features; the pilot was well forward for visibility, the big 37mm cannon could fire through the propeller shaft, thus not requiring synchronization, and the nose could be thin and streamlined yet house tricycle gear for rough field operation.

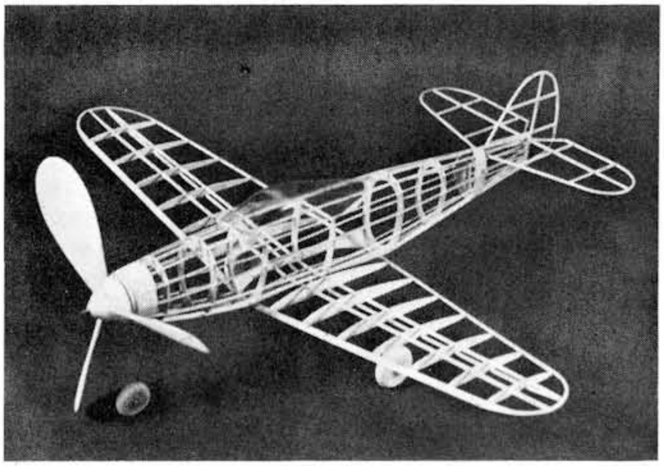
The P-39 first flew early in 1938 and had excellent performance, with the design weight of 6200 pounds and a supercharged engine. However the combat versions did not have the supercharger and weighed a ton more! Performance suffered so much that pilots, used to the nimble Spitfire, called the P-39 the "Iron Dog!" But the plane was tough, could carry a 500 pound bomb, and was well liked for attack missions. Several thousand were sent to Russia where it did good service in ground strafing.

The model is very realistic and flies well. It is built close to scale, with modest increases in stabilizer area, dihedral, and propeller size. Being a low winger with a short tail moment and smallish tail areas, it does not have much excess stability. Notice that the balance point is well forward. This increases the effectiveness of the tail and requires the negative able shown in the stabilizer. The original model was kept light by using medium grade balsa, built up wheels, 1/32 x 1/16 stringers, and a light coat of dope. It weighs three quarters of an ounce empty, and flies for about a minute . . . R.O.G.

When cutting the ribs and formers, do not notch them for the spars and stringers. Cut the notches after the parts are in position on the wing and the fuselage. Small errors in the notch positions cause an unsightly snakiness in the long strips. This can be avoided by sighting along the ribs and formers and mak-



Extremely light structure results in a light model, and that, coupled with a long-running rubber motor and large propeller, means maximum endurance as a flying scale model.

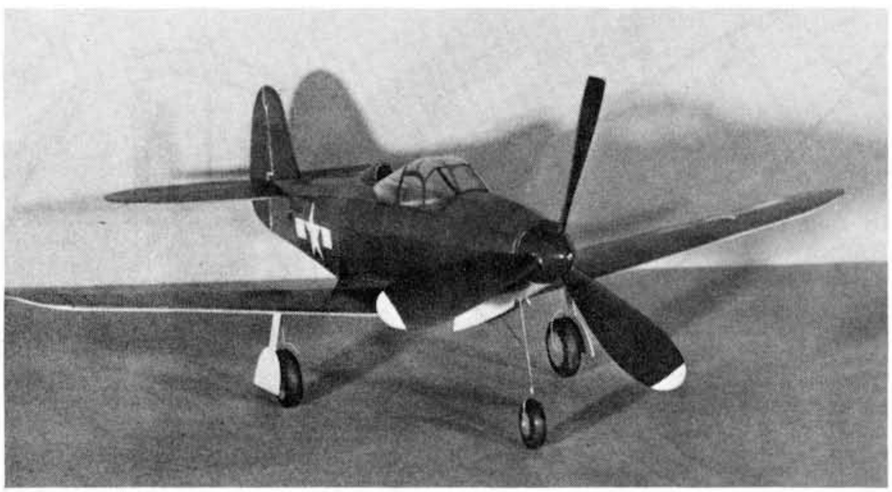


**Bulkhead material has been kept to a minimum for lightness, and tail surface outlines are laminated.**

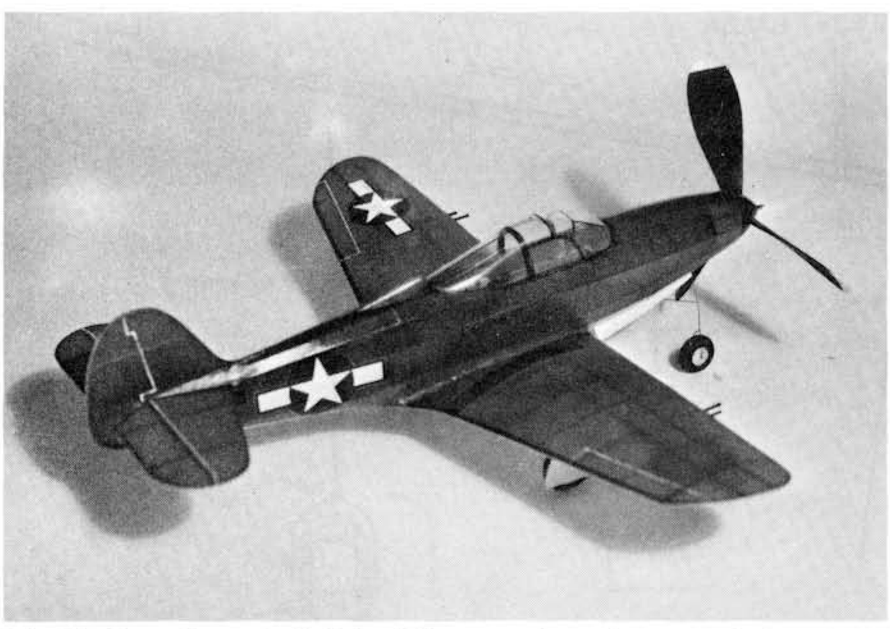
**Greatly enlarged photo of Airacobra as it passes overhead at considerable altitude.**

ing required adjustments in notch locations. As drawn, the formers are slightly oversize, to allow for tracing and cutting errors.

Note that the stringers are pre-bent before being glued in place so they won't pull the body out of shape. The top and bottom stringers can be continuous during body assembly. Later, when the rest of the fuselage is complete, sections under the canopy and over the wing can be cut out.



**Hand carved three-bladed balsa prop was found to be more efficient than the popular plastic ready-made two-bladers.**



**Only slight changes from scale dihedral, stabilizer area, and prop size were required to make the 'Cobra a good, realistic flier.**

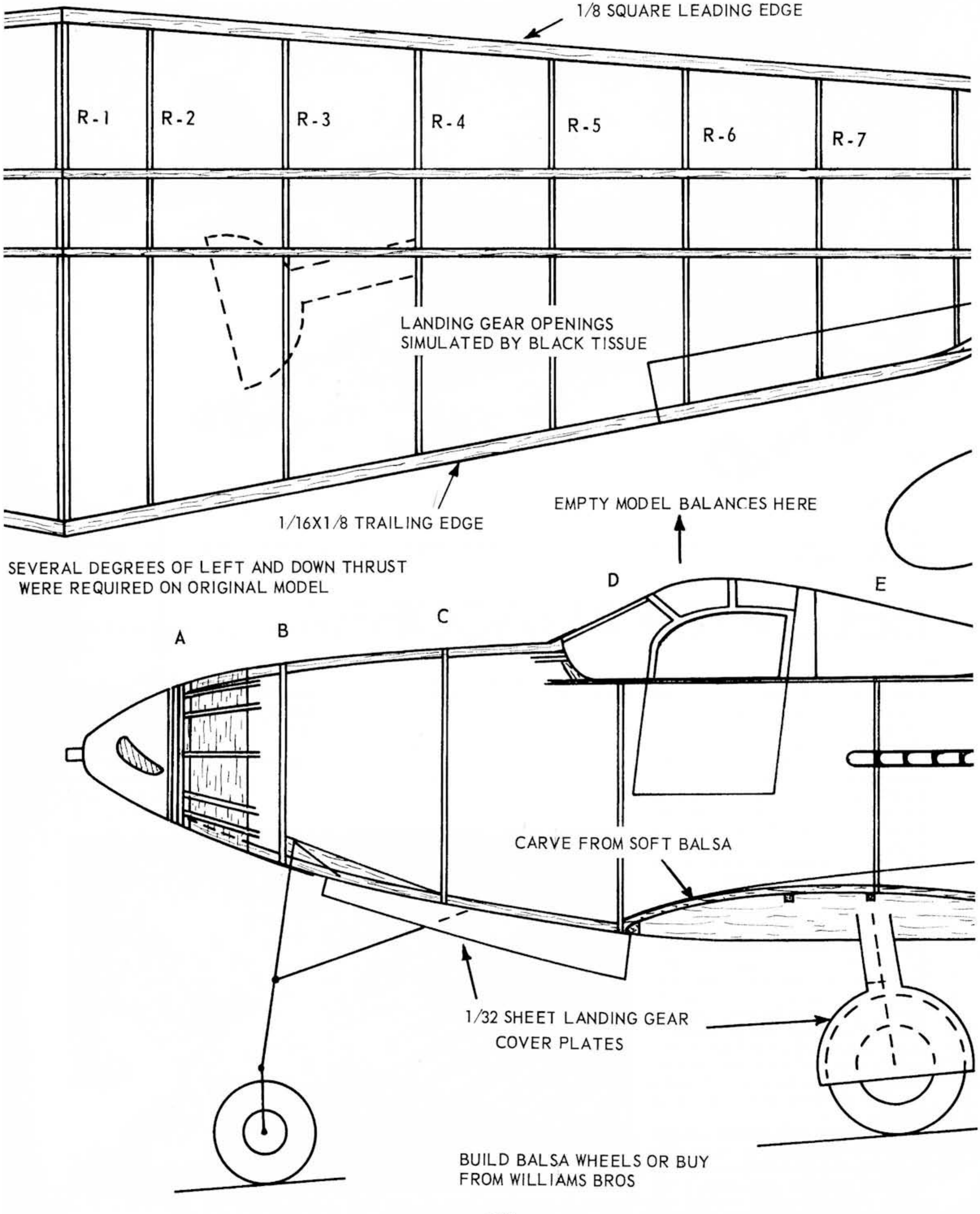
The canopy was molded over a form carved from spruce. It was a lot of work, but the results made it worthwhile. Heat-softening plastic sheet can be purchased from plastic supply firms The fillets are also a lot of work to fit to the complex fuselage curves, but certainly add to the appearance. Use 1/32 sheet to fill in part of the nose area, the rear peg area, and under the edges of the canopy.

Tail surfaces built of 1/16 square balsa may give warp problems if the tissue is shrunk and doped. It would be well to use 1/16 x 3/32 strips, with the deep side up, for extra strength. Such strips can be cut from sheet with a metal straight edge guide. Leave the area above the stabilizer uncovered until after flight tests so that the stabilizer angle can be changed if needed.

If the model is to be doped, use thin, well plasticized dope, and spray lightly. Use at least two parts thinner to one part dope and add ten drops of castor oil per ounce of dope. Castor oil works fine with nitrate dopes of lacquer. Use tricresyl phosphate (TCP) with butyrates.

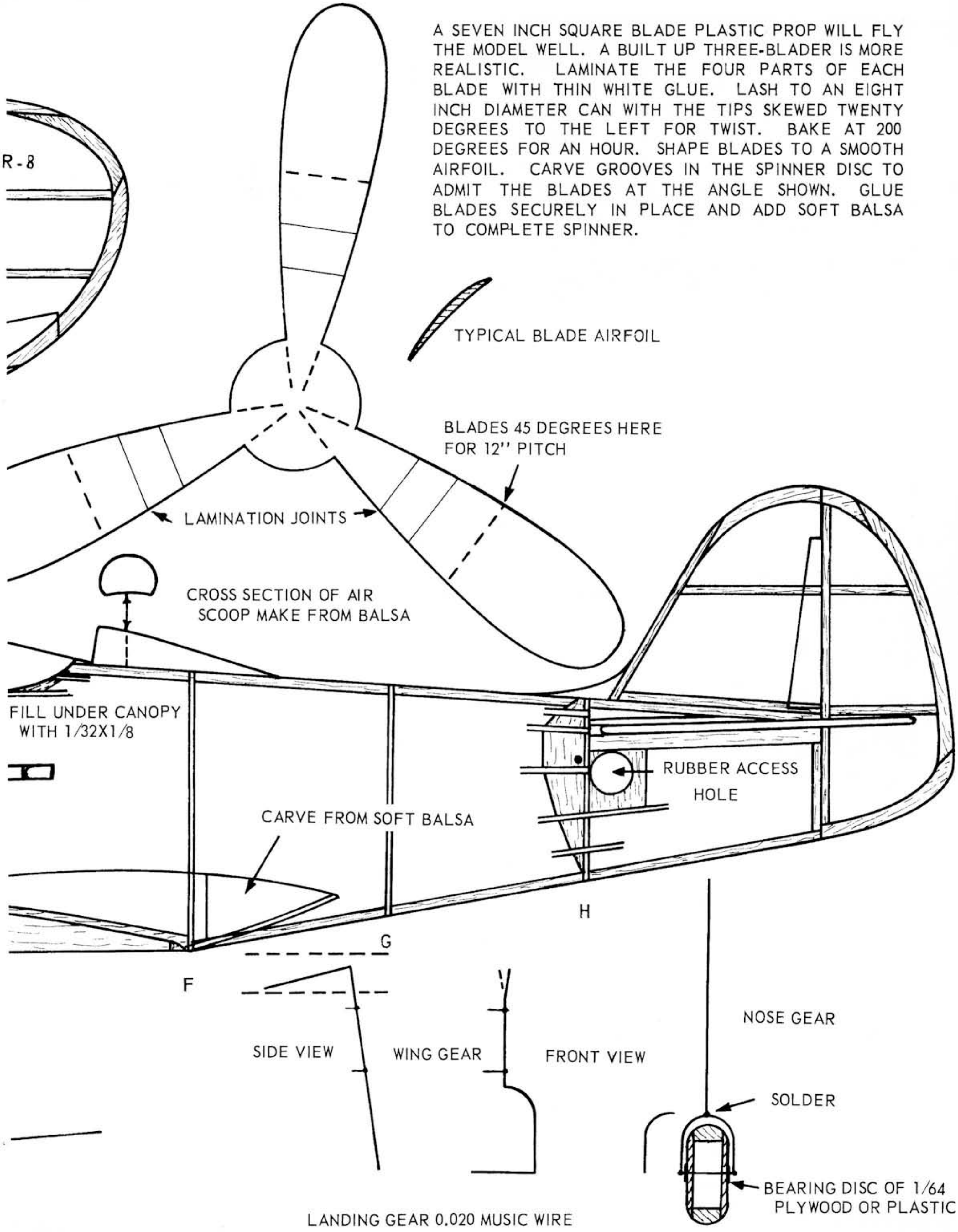
Before test flying, make certain that the balance point, the incidence angles, the wash-in, and the fin and prop offsets are as suggested. Use a shim of at least 1/16 thick balsa for down thrust between the top of the fuselage and the nose piece. Start with a loop of 5/32 Pirelli about ten inches long. Wind perhaps 100 times and launch slightly nose-down over tall grass, if possible. The model should be slightly nose heavy with the short motor. As longer motors are used for longer flights, they will bring the tail down.

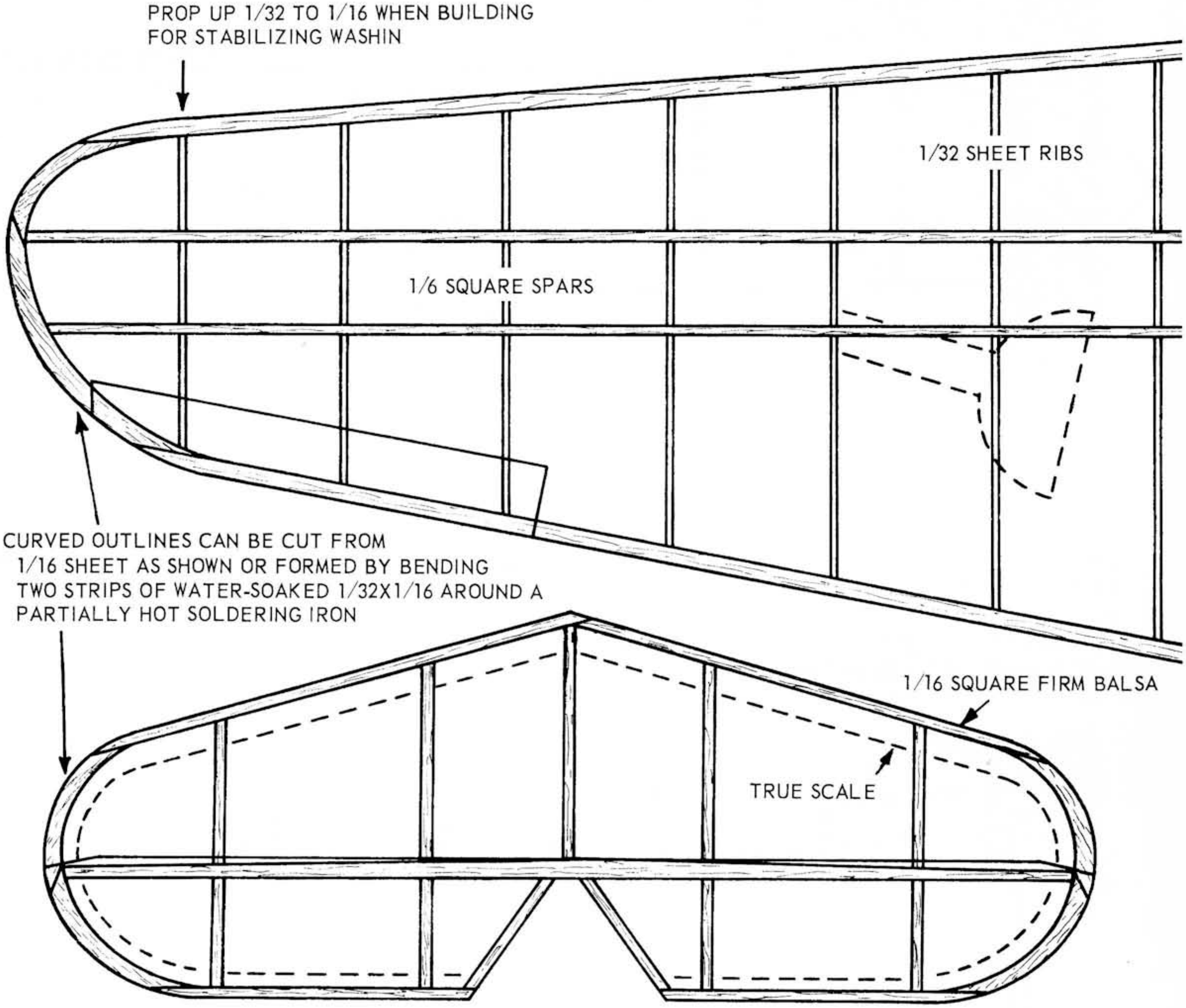
The drawings are enlargements from an old plan that we had cut out. It was used because it agreed best with photographs of the aircraft. Profile Publications is a good source of drawings and colorations. In the U.S.A., they are sold by: J.W.C. Aeronautica, 7506 Clybourn Ave., Sun Valley, Calif. 91352. ●

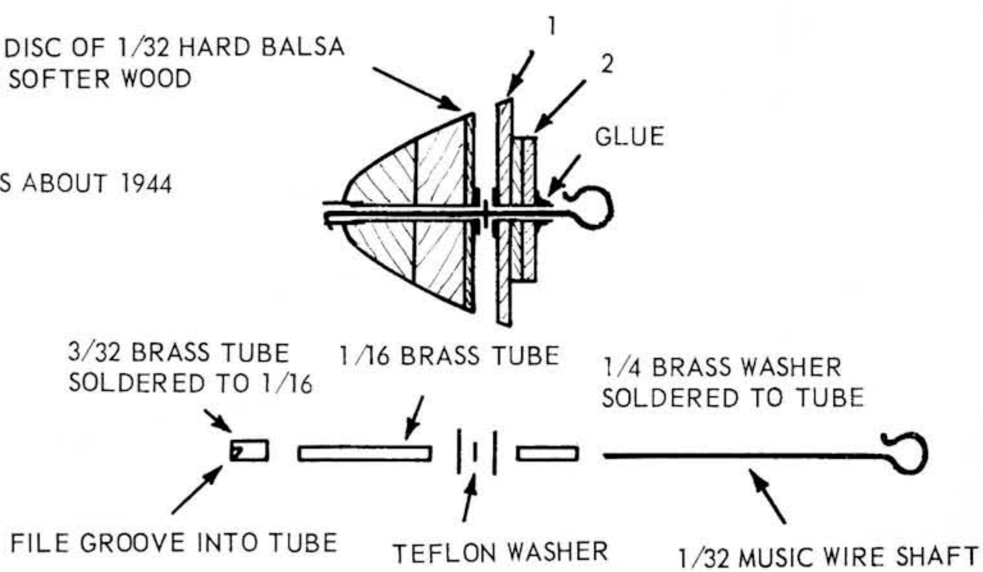

1/8 SQUARE LEADING EDGE
R-1
R-2
R-3
R-4
R-5
R-6
R-7
LANDING GEAR OPENINGS
SIMULATED BY BLACK TISSUE
1/16X1/8 TRAILING EDGE
EMPTY MODEL BALANCES HERE
SEVERAL DEGREES OF LEFT AND DOWN THRUST
WERE REQUIRED ON ORIGINAL MODEL
A
B
C
D
E
CARVE FROM SOFT BALSA
1/32 SHEET LANDING GEAR
COVER PLATES
BUILD BALSA WHEELS OR BUY
FROM WILLIAMS BROS

P-39

A SEVEN INCH SQUARE BLADE PLASTIC PROP WILL FLY THE MODEL WELL. A BUILT UP THREE-BLADER IS MORE REALISTIC. LAMINATE THE FOUR PARTS OF EACH BLADE WITH THIN WHITE GLUE. LASH TO AN EIGHT INCH DIAMETER CAN WITH THE TIPS SKEWED TWENTY DEGREES TO THE LEFT FOR TWIST. BAKE AT 200 DEGREES FOR AN HOUR. SHAPE BLADES TO A SMOOTH AIRFOIL. CARVE GROOVES IN THE SPINNER DISC TO ADMIT THE BLADES AT THE ANGLE SHOWN. GLUE BLADES SECURELY IN PLACE AND ADD SOFT BALSA TO COMPLETE SPINNER.





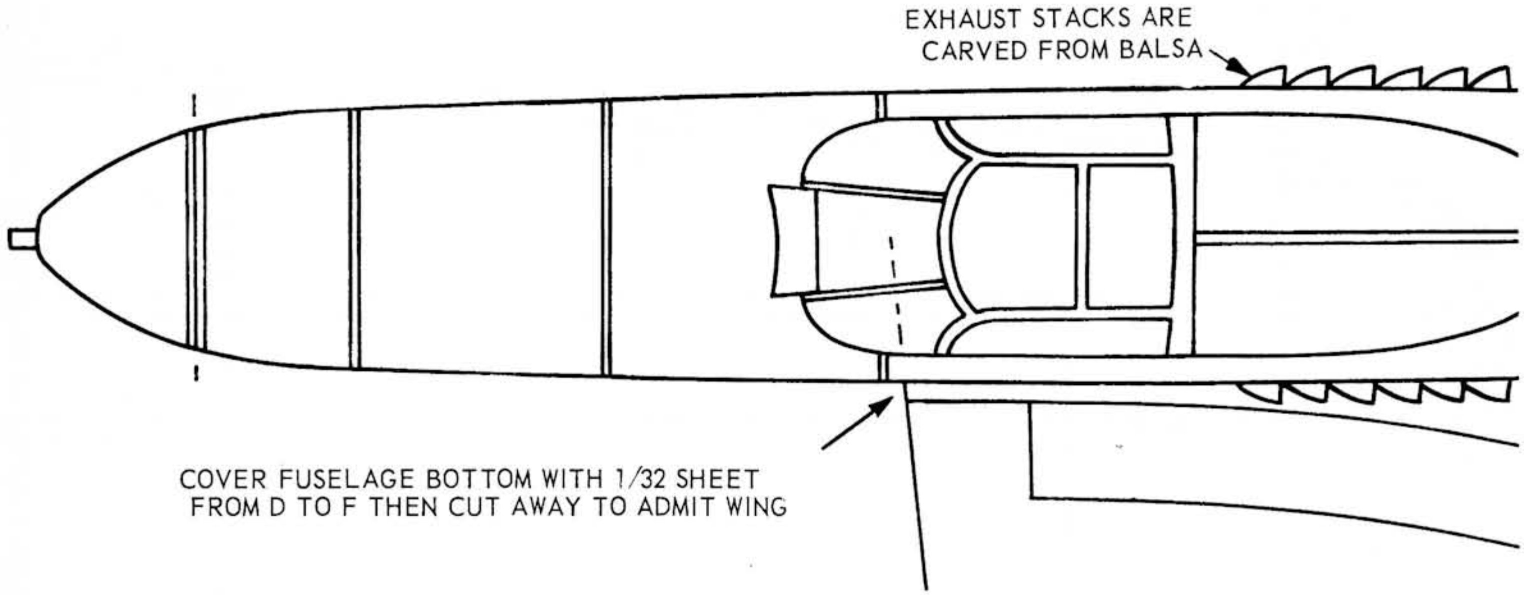



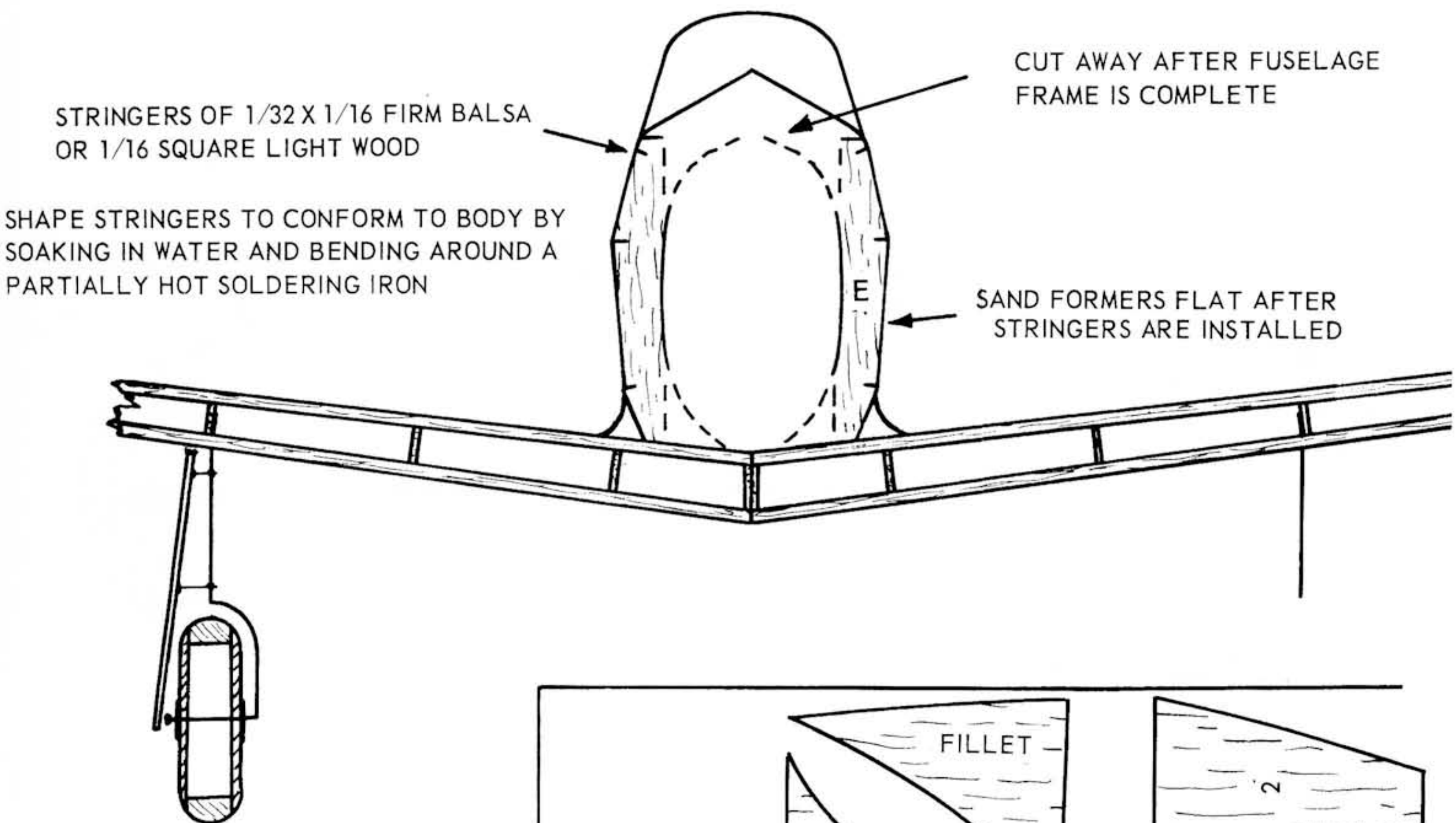

REFERENCE DRAWING FROM AIR TRAILS ABOUT 1944

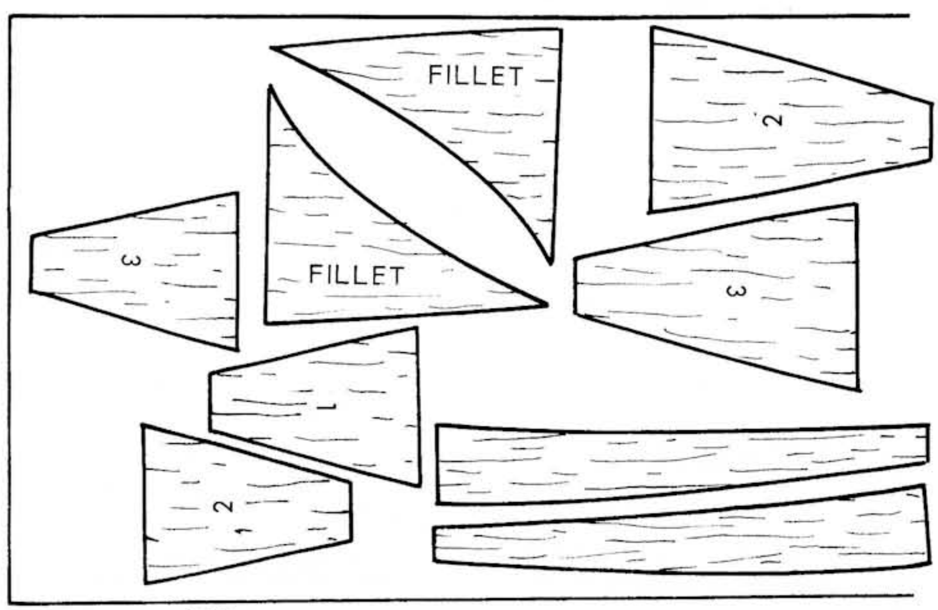
AIRACOBRA BELL P-39

SCALE 1/2" 1'

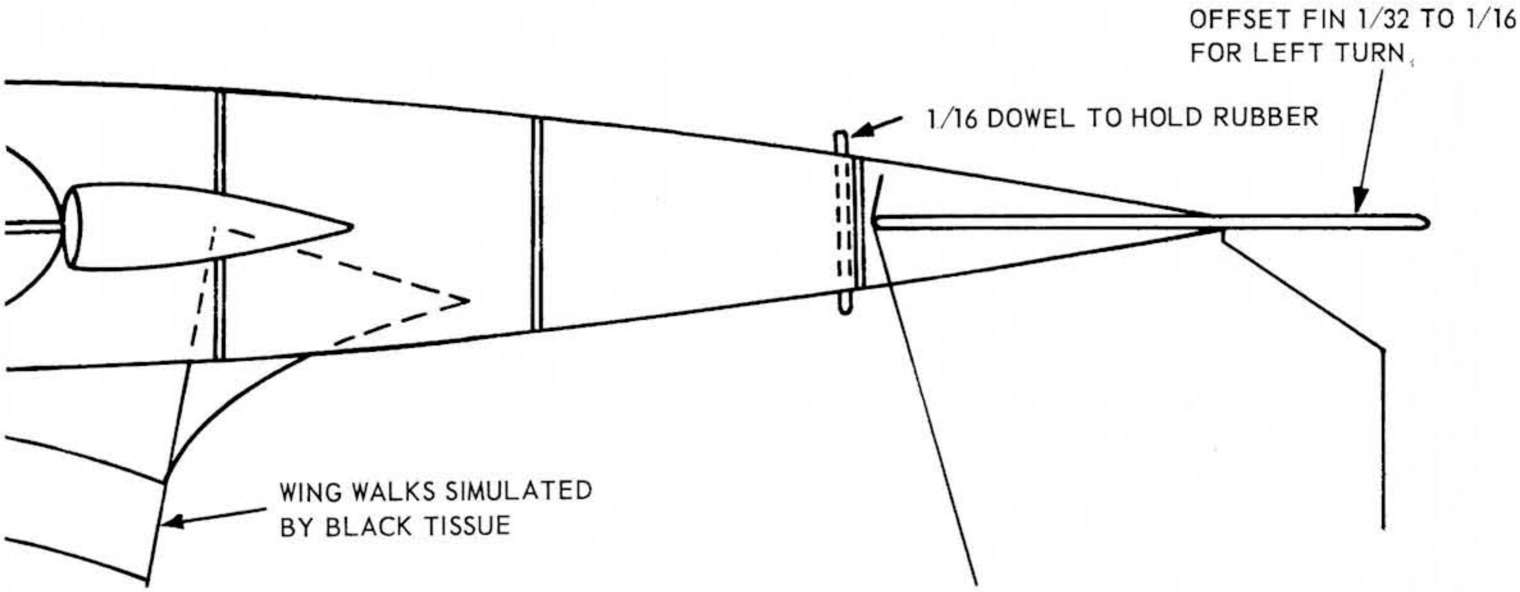
C Mather


EXHAUST STACKS ARE
CARVED FROM BALSA
COVER FUSELAGE BOTTOM WITH 1/32 SHEET
FROM D TO F THEN CUT AWAY TO ADMIT WING


STRINGERS OF 1/32 X 1/16 FIRM BALSA
OR 1/16 SQUARE LIGHT WOOD
SHAPE STRINGERS TO CONFORM TO BODY BY
SOAKING IN WATER AND BENDING AROUND A
PARTIALLY HOT SOLDERING IRON
CUT AWAY AFTER FUSELAGE
FRAME IS COMPLETE
E
SAND FORMERS FLAT AFTER
STRINGERS ARE INSTALLED

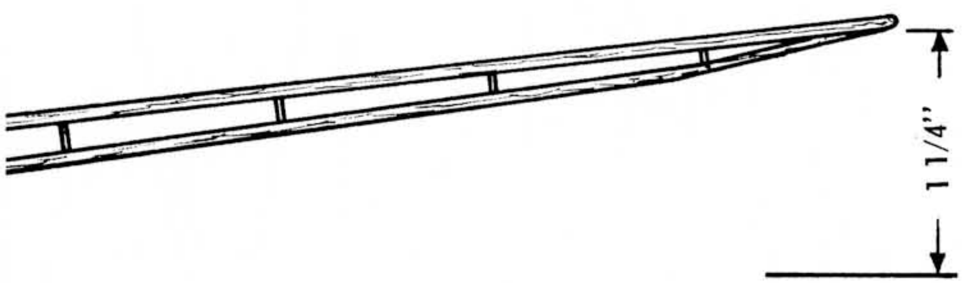

FILLET
FILLET
2
3
3
1
2

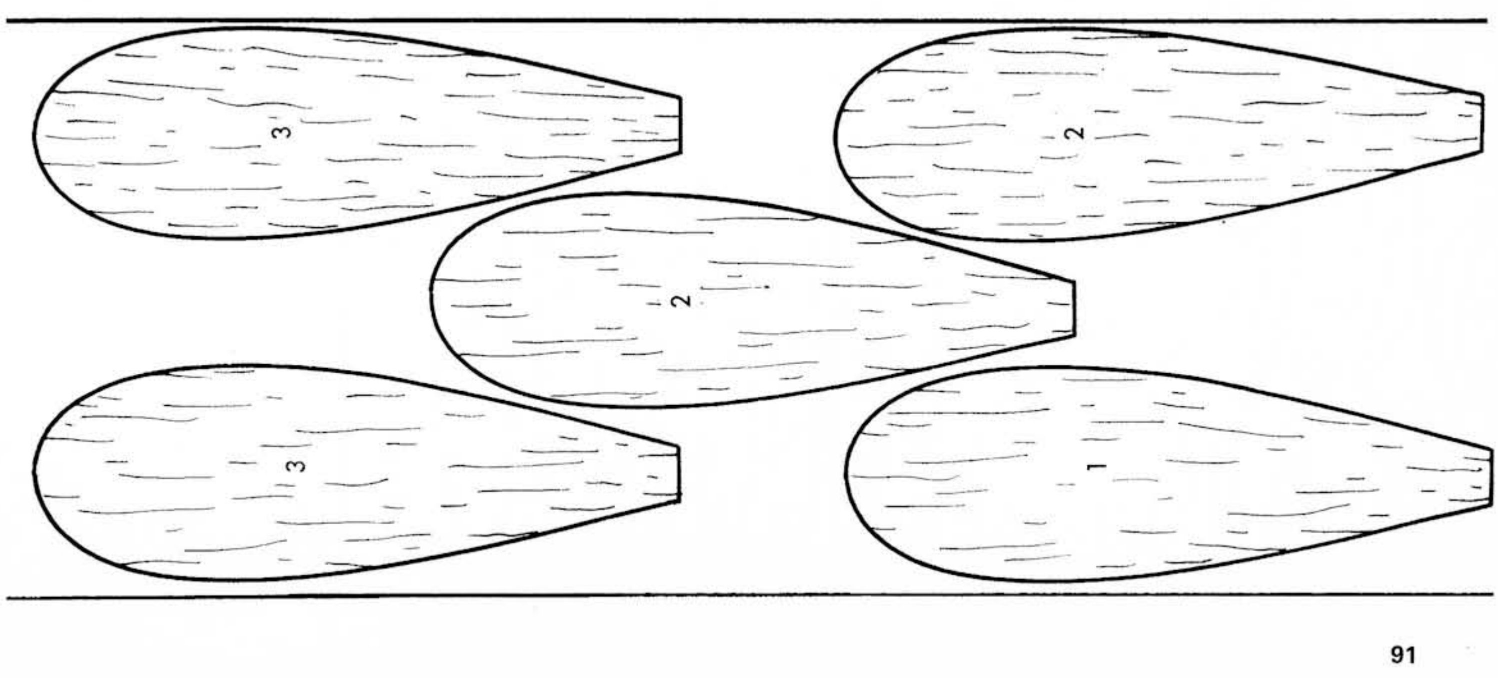
P-39

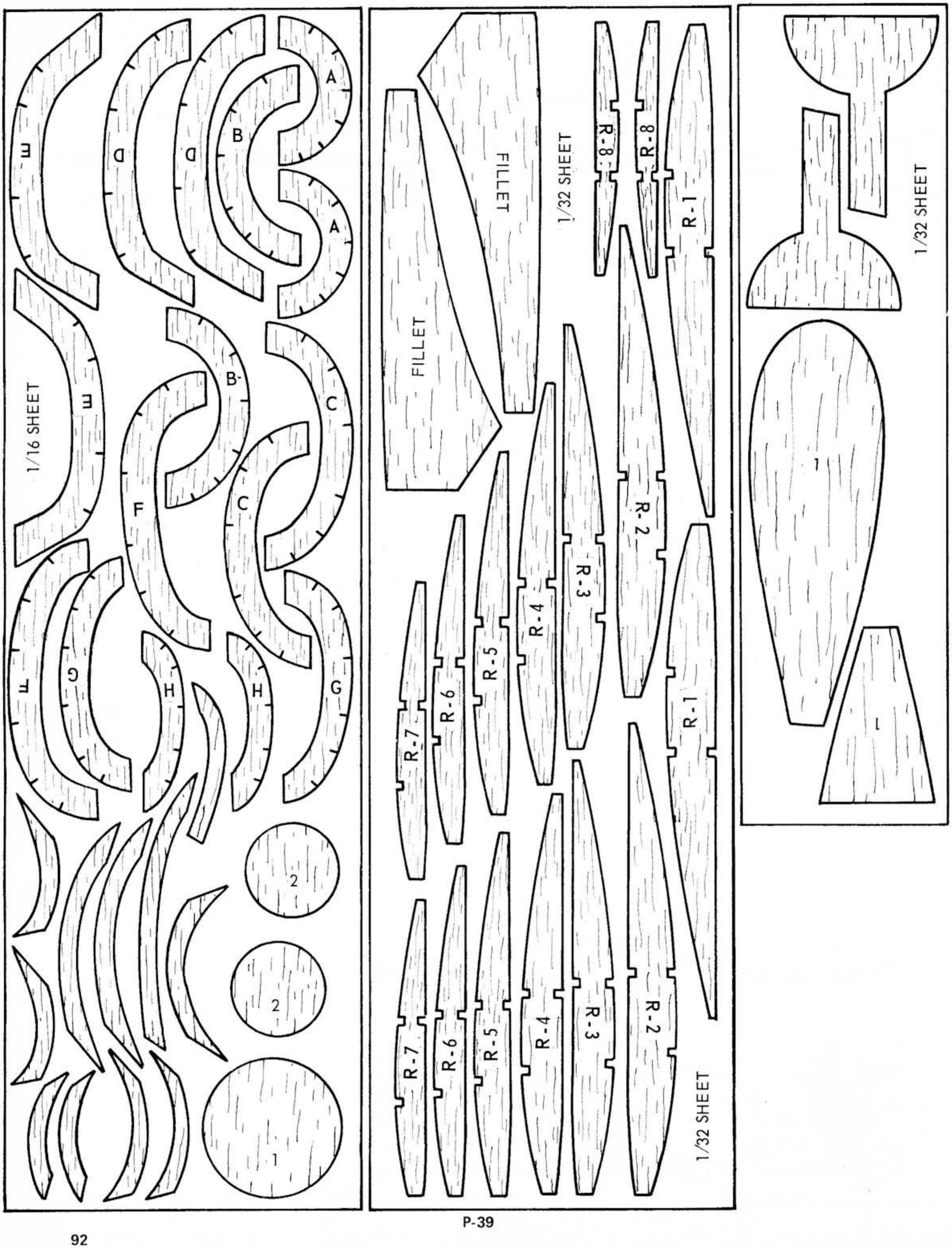



MODEL FLIES ON 1/8 TO 1/4 PIRELLI DEPENDING UPON THE PROPELLOR AND MODEL WEIGHT

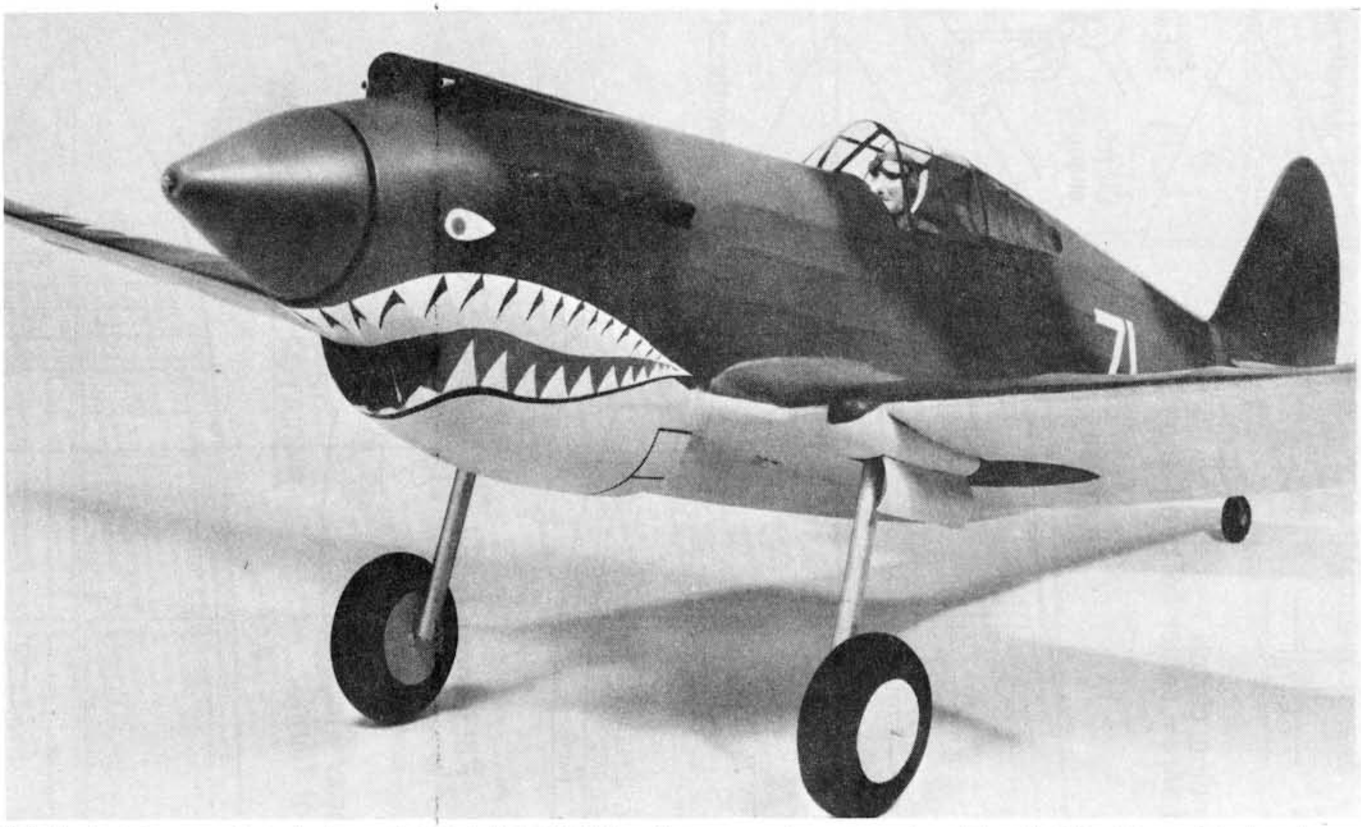
CAMOUFLAGE COLORS WERE OLIVE GREEN ON TOP AND GRAY BLUE UNDERNEATH






P-39



**"Oh the shark has . . pearly teeth dear . . ." And of all the P-40's in action, what are better remembered than the Flying Tigers of the American Volunteer Group in China? The author based his color scheme on one of these aircraft . . . teeth and all.**

# CURTISS P-40C

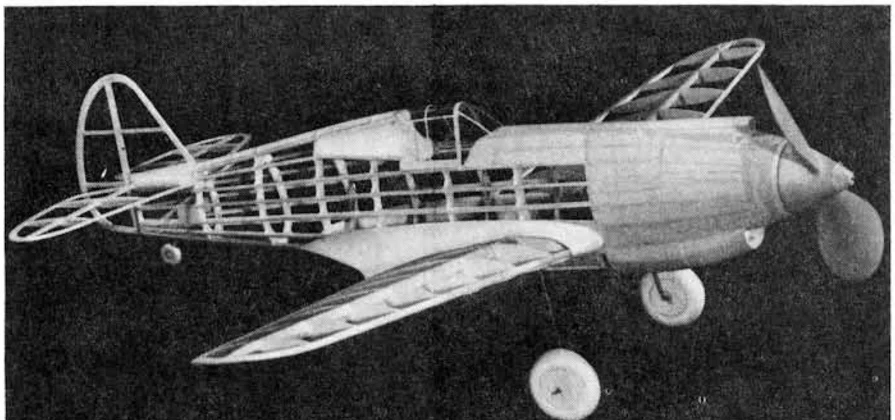
By J. D. McHARD

● From an unpromising start as a 1937 modification to the 1934 radial engined P-36, the Curtiss P-40 went on to become the spearhead of many a fighter arm in World War II, from North Africa with the R.A.F. (as the Tomahawk), to the Far East and China.

Faster than the Hurricane but slower than the Spitfire and Messerschmitt Bf 109E, the P-40 was based upon a proven airframe, and could be produced relatively quickly. In consequence, the decision was made in April 1939 to place a substantial order for 524 machines. The importance of this move can best be gauged by the orders placed at the same time for two more advanced aircraft . . . the Lockheed YP-38 and the Bell YP-39 . . . thirteen of each!

Delivery of the first production armament consisted of two .50 machine guns over the engine and a .30 machine gun in each wing.

The P-40 was a big aeroplane . . . particularly when compared with, say the Messerschmitt Me-109, which possessed similar power and armament. Its beard radiator just screamed out for someone to adorn it with a shark's mouth!



**The P-40 nose provides a good exercise in the art of filling in with sheet balsa! Tail surfaces are typically light to reduce the need for excess balancing weight in the nose.**

Numerous artists availed themselves of the opportunity, but the most famous sharkmouthed P-40's must surely have been those serving with the American Volunteer Group in China, around which so much aviation literature has been written.

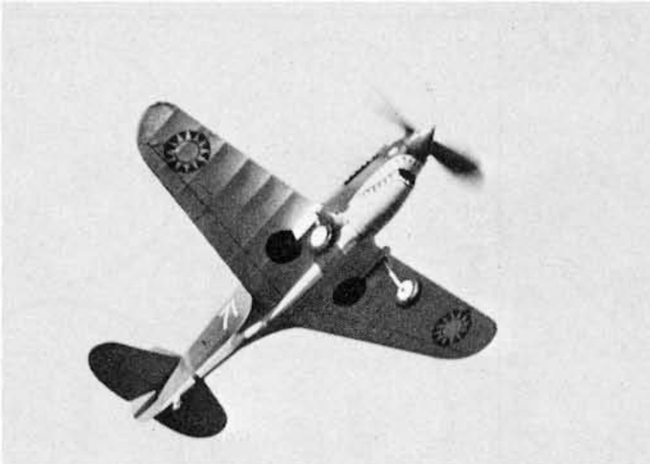
Our model is based upon a machine serving with the A.V.G. in China, but there are, of course, numerous other schemes from which to choose if the intricacy of that sharkmouth daunts you a little.

The P-40 is a big model . . . or at least the fuselage is! The exceptionally long nose assists balance problems, but don't be deceived into thinking that weight-watching around the tail is any less important. You *still* need a little weight in the nose, so the more you save at the back, the less dead weight you'll need at the front.

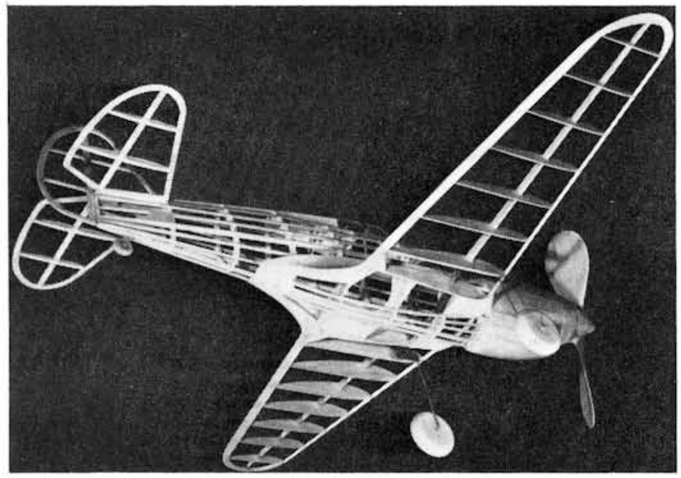
The photographs show the model as originally built and, clearly, the landing gear legs are a bit too long. Strangely enough this did not become apparent until the photos were printed. The legs were afterwards shortened by about 3/16 inch and the appearance has been greatly improved.

REFERENCES

Profile Publications No. 35 "The Curtiss P-40 Tomahawk".
Monogram Plastic Model Kit. ●

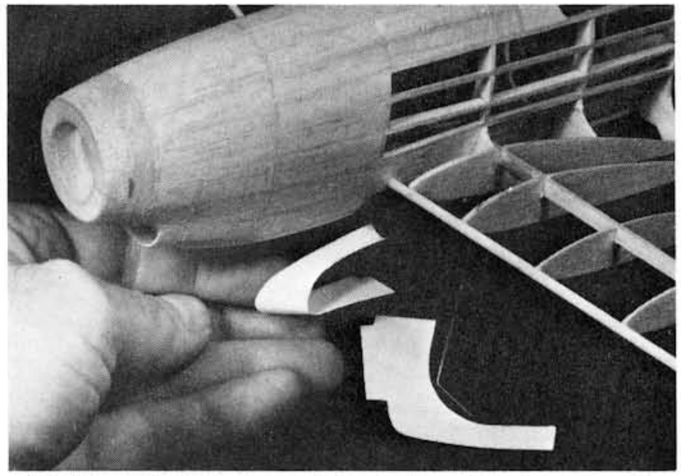


Showing off its A.V.G. markings, the author's P-40 is off on another stable flight. Long nose helped in balancing.

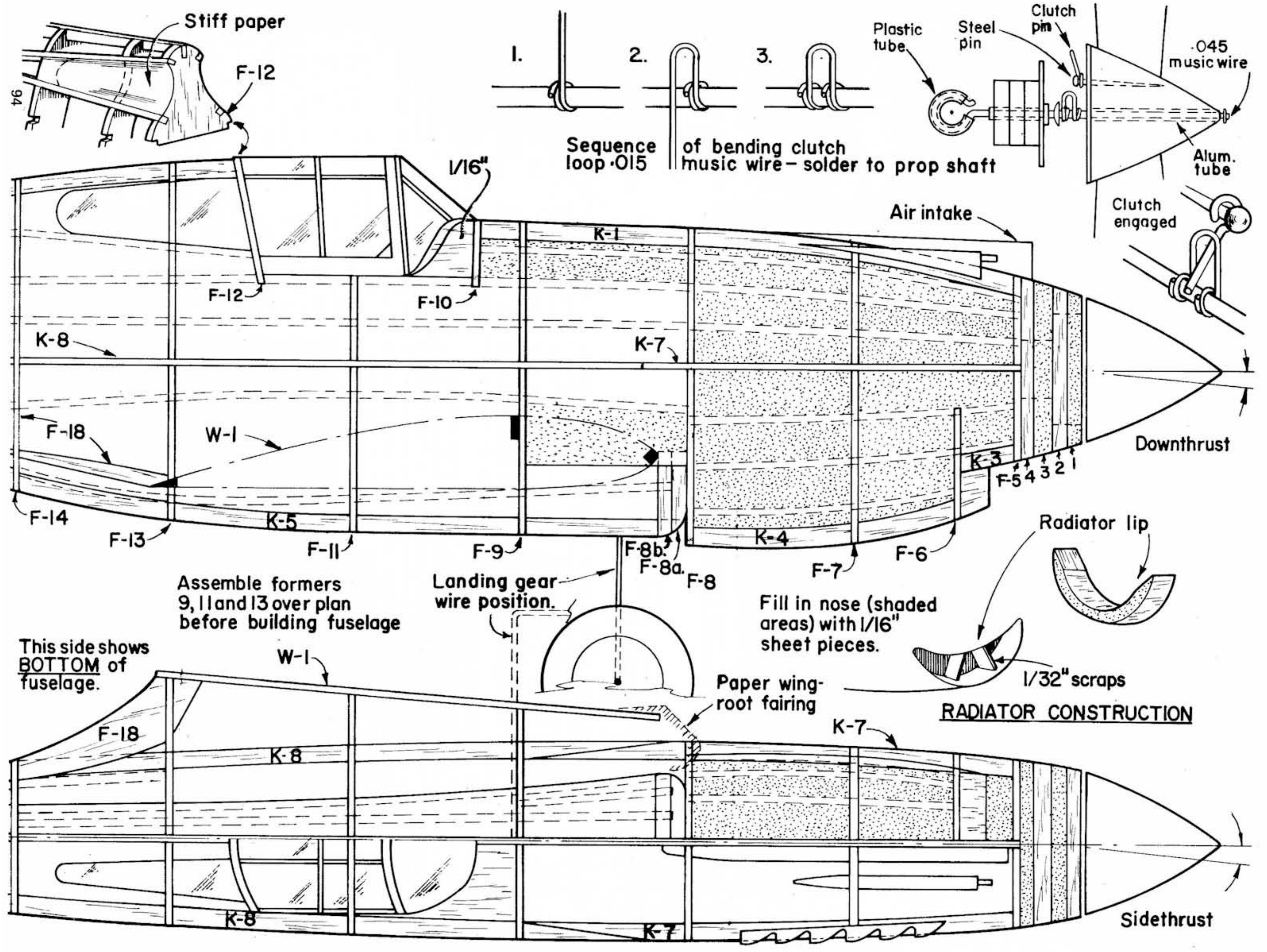


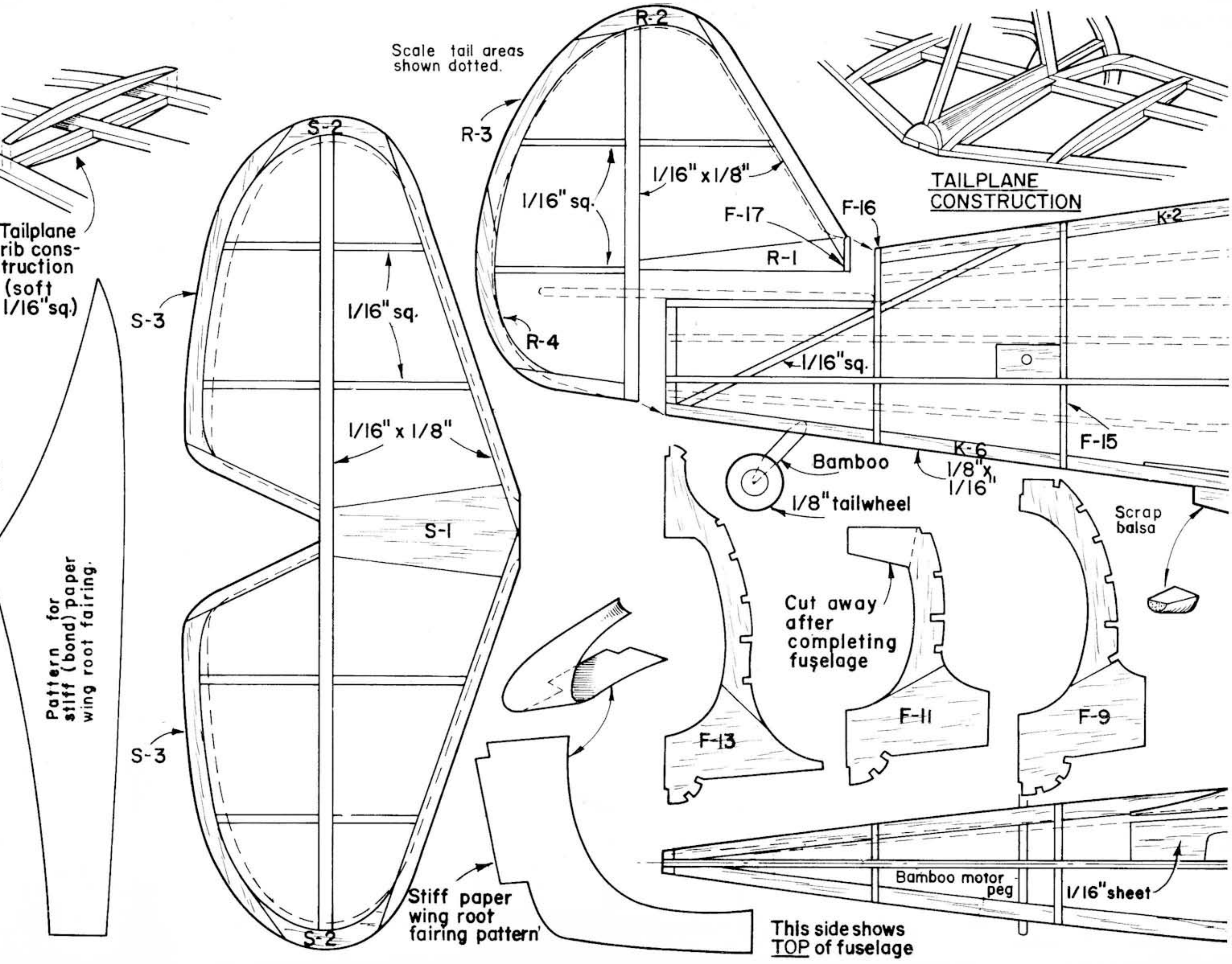
Landing gear was shortened by 3/16 inch after these photos were taken, when Doug first realized he had made them too long!


Markings on the A.V.G. P-40's were fairly simple, but doing the shark's mouth can be quite a project.

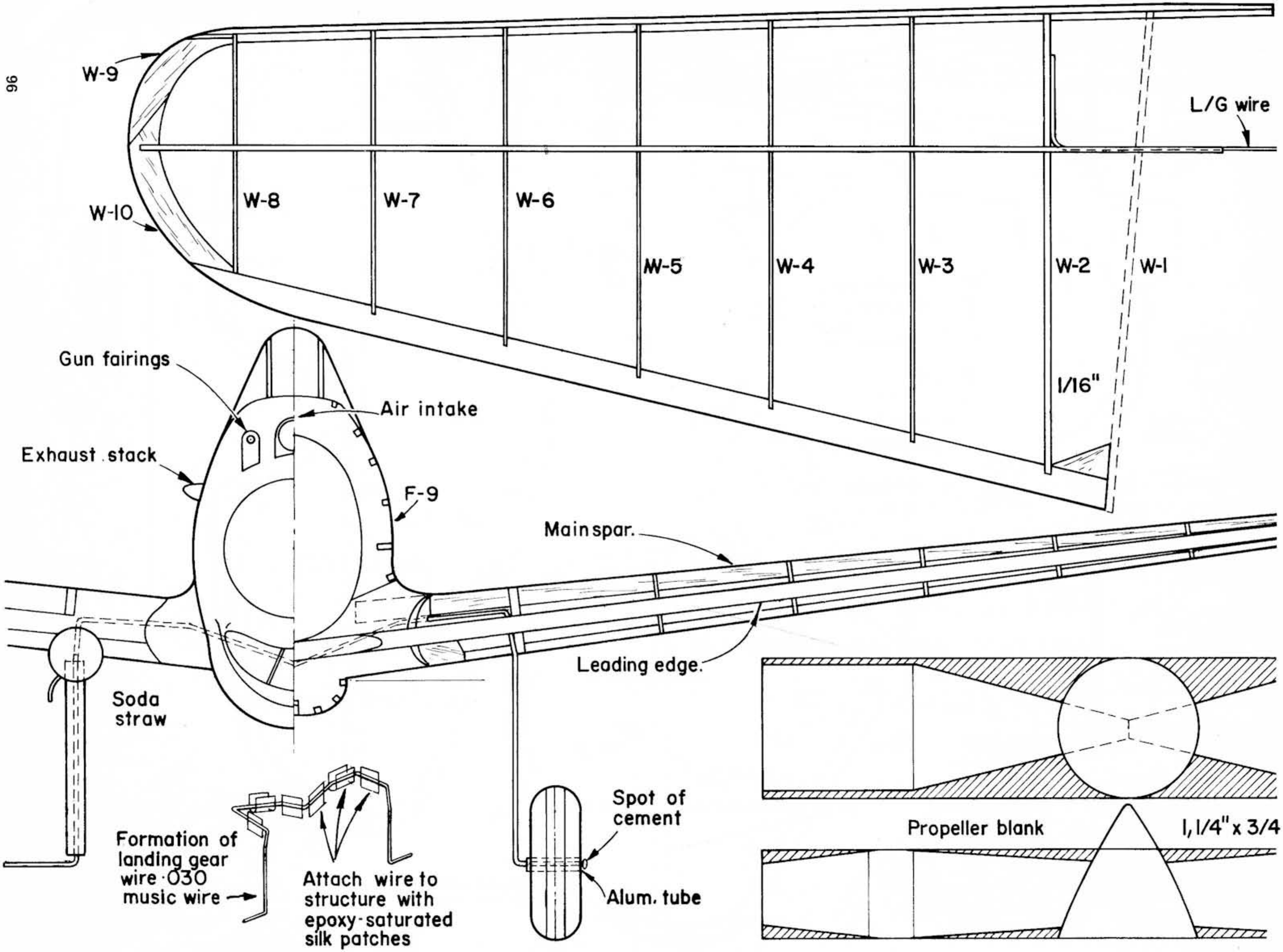


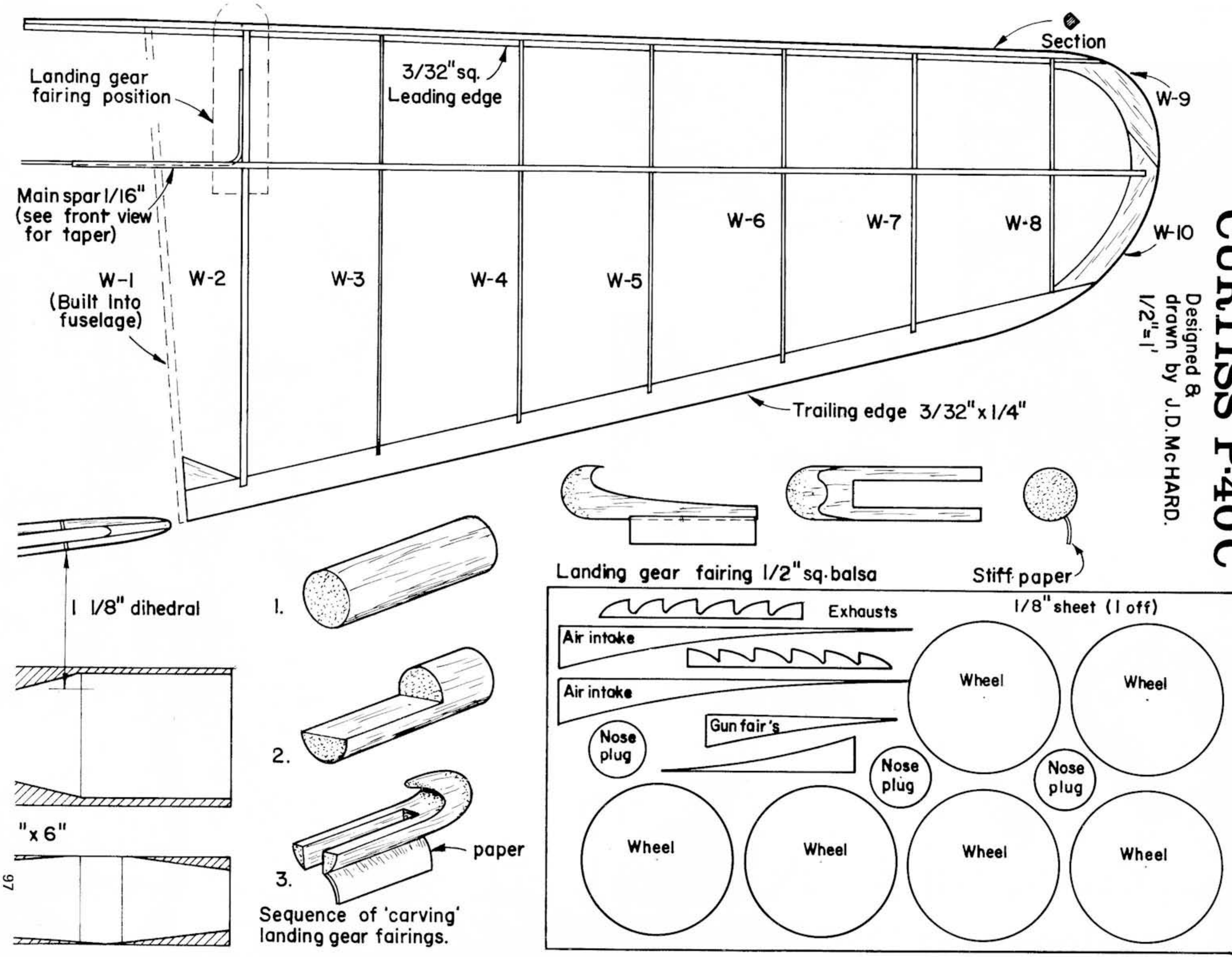
The Mattel Vac-U-Form came in handy for making these wing fillets. Neat sheet balsa nose fill-in work shows clearly in this photo.

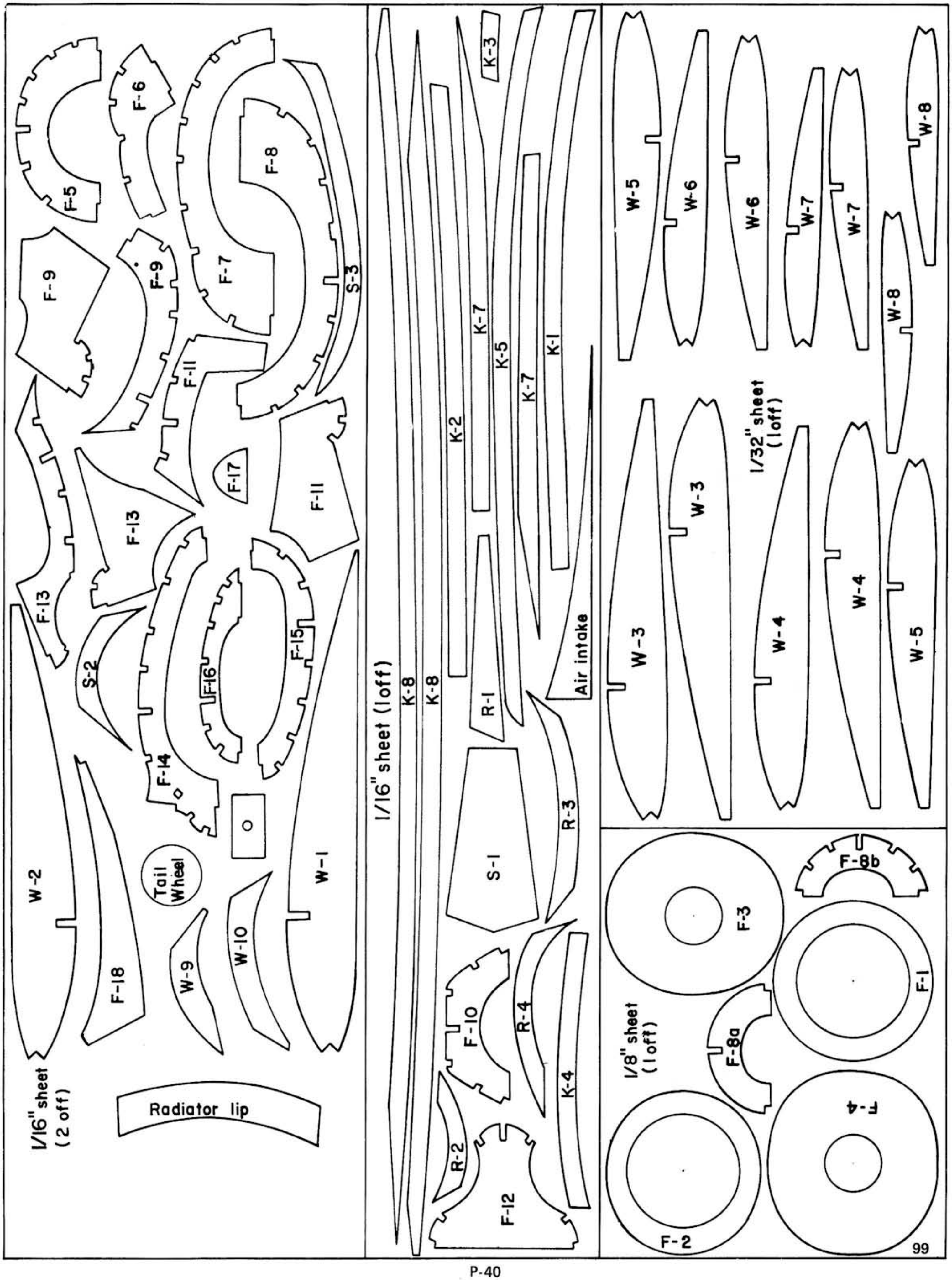

94
Stiff paper
F-12
1.
2.
3.
Sequence of bending clutch loop .015 music wire – solder to prop shaft
Plastic tube
Steel pin
Clutch pin
.045 music wire
Alum. tube
Clutch engaged
1/16"
Air intake
K-1
F-12
F-10
K-8
K-7
F-18
W-1
K-3
F-5 4 3 2 1
Downthrust
F-14
F-13
K-5
F-11
F-9
F-8b.
F-8a.
F-8
K-4
F-7
F-6
Radiator lip
Assemble formers 9, 11 and 13 over plan before building fuselage
Landing gear wire position.
Fill in nose (shaded areas) with 1/16" sheet pieces.
This side shows BOTTOM of fuselage.
W-1
Paper wing-root fairing
1/32" scraps
RADIATOR CONSTRUCTION
F-18
K-8
K-7
K-8
K-7
Sidethrust


Scale tail areas shown dotted.
Tailplane rib construction (soft 1/16"sq.)
Pattern for stiff (bond) paper wing root fairing.
S-2
S-3
1/16" sq.
1/16" x 1/8"
S-1
S-3
S-2
Stiff paper wing root fairing pattern
R-2
R-3
1/16" sq.
1/16" x 1/8"
F-17
R-1
F-16
R-4
1/16"sq.
TAILPLANE CONSTRUCTION
K-2
F-15
K-6
1/8" x 1/16"
Bamboo
1/8" tailwheel
Scrap balsa
Cut away after completing fuselage
F-13
F-11
F-9
Bamboo motor peg
1/16" sheet
This side shows TOP of fuselage

P-40


W-9
W-10
W-8
W-7
W-6
W-5
W-4
W-3
W-2
W-1
L/G wire
1/16"
Gun fairings
Air intake
Exhaust stack
F-9
Main spar.
Leading edge.
Soda straw
Formation of landing gear wire ·030 music wire
Attach wire to structure with epoxy-saturated silk patches
Spot of cement
Alum. tube
Propeller blank
1, 1/4" x 3/4


CURTISS P-40C
Designed & drawn by J.D.McHARD.
1/2"=1'
Section
W-9
W-10
3/32"sq. Leading edge
Landing gear fairing position
Main spar 1/16" (see front view for taper)
W-1 (Built into fuselage)
W-2
W-3
W-4
W-5
W-6
W-7
W-8
Trailing edge 3/32"x1/4"
1 1/8" dihedral
"x 6"
1.
2.
3.
paper
Sequence of 'carving' landing gear fairings.
Landing gear fairing 1/2" sq. balsa
Stiff paper
Exhausts
1/8" sheet (1 off)
Air intake
Air intake
Gun fair's
Nose plug
Nose plug
Nose plug
Wheel
Wheel
Wheel
Wheel
Wheel
Wheel


1/16" sheet (2 off)
F-5
F-6
F-7
F-8
S-3
F-9
F-9
F-11
F-17
F-11
F-13
F-13
S-2
F-16
F-15
F-14
W-2
F-18
Tail Wheel
W-9
W-10
W-1
Radiator lip
1/16" sheet (1 off)
K-3
K-7
K-5
K-1
K-7
K-2
K-8
K-8
Air intake
R-1
S-1
R-3
F-10
R-4
K-4
R-2
F-12
1/32" sheet (1 off)
W-5
W-6
W-6
W-7
W-7
W-8
W-8
W-3
W-3
W-4
W-4
W-5
1/8" sheet (1 off)
F-8b
F-3
F-1
F-8a
F-4
F-2
99

**The rugged and powerful lines of the P-47 Thunderbolt are clearly evident in this photo of the author's model. Note $CO_2$ engine and filler fitting inside the cowl.**

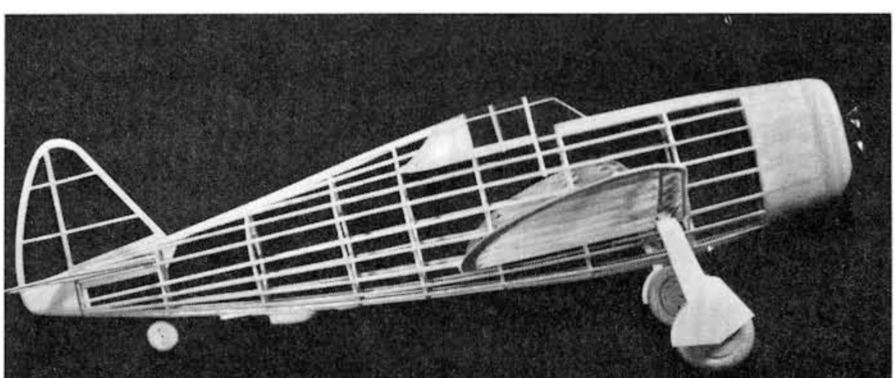
# P-47D THUNDERBOLT

**By E. I. COLEMAN**

● Thunderbolt . . . a name to inspire visions of the ancient war gods! Strength in abundance . . . more than enough to do its job, and still be able to absorb the combat punishment of its adversaries.

Conceived by Alexander Kartvelli during the summer of 1940, the P-47 was by far the largest and heaviest single-engine fighter developed to that date, and it heralded an entirely new concept in single-seat military aircraft. While space does not permit detailing the fantastic aerial achievements and outstanding record of this machine, suffice to say that every pilot of "Ace" status who flew the Thunderbolt survived the war. Members of the 56th Fighter Group achieved a ratio of 8 victories for every loss, a highly unusual attainment for ANY combat aircraft.

The P-47 has been published and kitted frequently as a model, but unfortunately, often with glaring errors. Supposedly authentic scale drawings, some claiming "absolute accuracy" have appeared, and yet, comparison with photographs completely discredits the majority of them. In developing our model, we worked from drawings obtained from Model & Allied Publications Ltd., P.O. Box 35, Bridge Street, Hemel Hempstead, Herts HP1 1EE England. After years of collecting photos, articles, and books relating to the P-47, we consider the MAP drawings to be the best scale reference to be found. In our opinion, these drawings are accurate in scale outline, dihedral, and all visible details. The "razorback" version was selected to be modeled because of personal preference. Even allowing for the fact that "beauty is only in the eye of the beholder", we feel that no more beautiful aircraft ever existed! If our model manages to capture the essence of the original, with its deep belly, distinctive turtleback, and massive yet graceful appearance, we will consider it to be a success. On to the actual construction.



**The "Jug" without covering. Typically, the nose is filled in with sheet balsa, and the tail surfaces are built as light as possible to avoid excessive ballasting weight.**

SELECTION OF MATERIALS

The model was designed for outdoor flying under average weather conditions, and materials were selected accordingly. Medium firm wood was used with certain exceptions, such as the wing spars, leading and trailing edges, rear motor peg mounts and front cowling ring, which were made from hard stock. Particular care was taken to keep the rear of the fuselage and tail surfaces light, to minimize the need for nose ballast.

FUSELAGE

The fuselage is constructed in the traditional "half shell" manner. Basic keels are cut from the printed part sheets, glued together, and pinned to the workboard directly over the plan while drying. All bulkheads are cut from 1/16 sheet balsa, and two of each half are required. Cement one set of bulkhead halves in their respective locations along the upper and lower keels. Use a small square block of balsa to check the vertical alignment of each. Allow to dry thoroughly. Meanwhile, cut out two side keels from printed part sheets, which can be assembled directly over the top view drawing. When dry, they may be removed from the board, and one of them installed on the fuselage half shell. The wing base is installed now.

After drying, lift the assembly from the work board and continue by carefully gluing the second set of bulkhead halves in position and adding the second side keel. Be sure there is no pulling or distortion of either the keels or wings base parts at this point.

Begin installing the fuselage stringers, first giving each a trial installation. Occasionally, a stringer will be found to have a slight "bend" in it and will not follow the contour between bulkheads smoothly. In this event, enlarge bulkhead notches as needed to shift the stringer into alignment. Afterwards the oversize notch may be filled in with scrap wood, if desired. Taking the time to make these small corrections will result in a better final product. As each stringer is installed, its opposite number should be next in place. The object, of course, is to avoid pulling the fuselage out of line, which may occur if more than one stringer is added to one side at a time. Once the stringers are in place, the short keel piece between F-4 and F-5 may be eliminated, and the instrument panel glued on.

Install the 1/16 inch sheet balsa wing saddle pieces as indicated on the side view drawing. Glue on the nose block laminations. Then finish sanding the inner surface of the three front ring laminations before installing. Note that the nose button is removable for winding, but should be a snug fit. The forward position of the fuselage may be filled in between the stringers with soft 1/16 inch sheet. The method is rather tedious, but results in an exceedingly strong assembly. Dead soft scraps of 1/8 balsa are filled in between formers 5 and 7 and the top stringer and keel piece in order to achieve a transition from round turtledeck to the razorback inverted V at No. 7. The author prefers a black cockpit interior to simulate depth.

## WINGS

Cut two each of the wing ribs from 1/32 sheet balsa, except for W-1, which is 1/16 sheet. Pin the printed part trailing edge pieces and the 1/16 square lower spar onto the building board directly over the plan. Install each wing rib, trimming slightly, if required, for a perfect fit. Next, install the printed part leading edge. Note that the trailing edge tips are elevated an extra 3/32 inch to provide wash-out, as a stability aid. Add both upper spars, and the gussets at W-1 for proper dihedral. Carve and sandpaper the leading and edges to final contour.


**Wide tread of the landing gear shows up well from this angle. As was the prototype, the P-47 is the largest single-engine fighter model in this series.**

## TAILPLANES

The tail surfaces are constructed from 1/16 inch square balsa strips plus the printed parts, directly over the drawings. When dry, remove from board, and sand edges to a rounded contour.

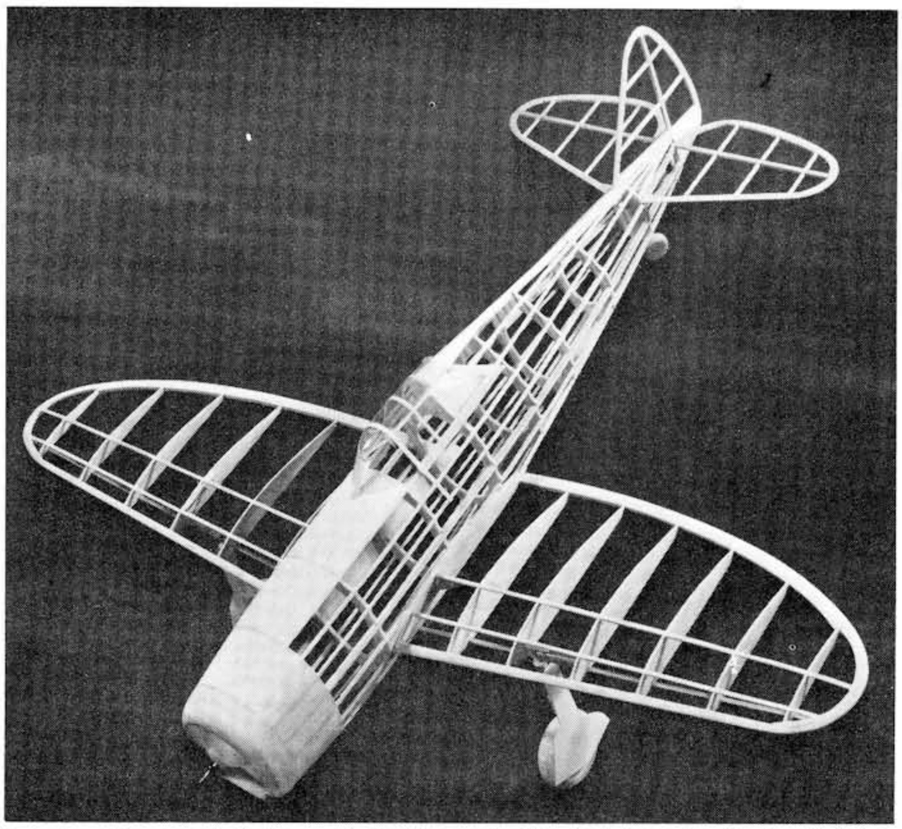
## LANDING GEAR

The main landing gear struts are bent from 1/32 inch diameter music wire, as indicated. These are sandwiched with 1/16 inch hard balsa reinforcement pieces, or sewn with thread, and glued firmly in place. The detailing is best added after the wings are covered with tissue, but will be described here.

Build up the main struts from balsa which is sanded round then split to permit installation around the landing gear leg wire. Strips of paper are wound and glued on to build up the various areas of different diameters. The landing gear leg covers and doors are thin card stock, with other details of scrap balsa, etc. Again, it is suggested that photos of the real machines be examined by those who may care to add extensive detailing. While it would be possible to construct actual wheel wells, we elected to simply simulate them with black paint. Wheels were built up as shown and mounted in a hand drill to be sanded to shape as if on a lathe.

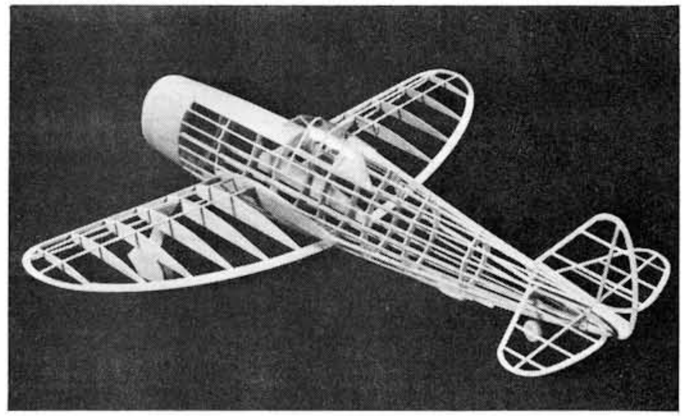
## COVERING

All structure should be carefully



**Top view of framework displays most all of the construction technique. As with all scale flying models, the order of the day is "strength with lightness."**


Covering, painting, and finishing are all well detailed in Doug McHard's photo/article starting on page 118.



Wings are butt-glued to wing bases in fuselage. With this arrangement, parts may be covered before assembly.

sanded to blend the components together and eliminate surface roughness and any slight misalignments. The bulkhead areas between the fuselage stringers may be scalloped with a round sanding stick, for a smoother covering job. The technique used for tissue and paint is described in the J. D. McHard article elsewhere in this book.

CANOPY

The original model canopy was formed over a carved balsa block. The mold should be primered and sandpapered to minimize the grain of the wood. Chart tape can be used for the frame outlines, as can colored tissue paper. Alternatively, the canopy can be suitably masked and the lines painted on.

A duplicate vacuum-formed canopy may be ordered from Sig Mfg. Co., Montezuma, Iowa.

ASSEMBLY

Trial fit the wing panels to be certain of alignment, and if necessary, trim for a perfect fit. When both panels fit properly, glue them in place. Be generous with the adhesive, since the wings must absorb not only flight loads, but the landing-gear shocks as well.

Cut the slot from the rear fuselage to allow the stabilizer to be installed. Check the alignment of the stab carefully, and glue in position. Cut a small piece of 1/16 sheet balsa to serve as a filler behind the stabilizer, cover the stabilizer, cover the exposed edges with appropriate color tissue, and glue in place. Check the fit of the vertical tail, and if satisfactory glue into position.

Add the various remaining details such as antenna masts, landing gear doors, tail wheel details, etc. It is suggested that the antenna wires be left off until test flying has been completed, since they tend to interfere with handling of the model.

A simple, yet effective engine can be simulated with Williams Brothers 3/4 inch scale dummy cylinders. These can be cut in half, modified as required, and fastened to the inside cowl face with contact cement.

PROPELLER

Our test model was flown with a 7 inch diameter Kaysun Plastic prop, worked quite well. Our drawing includes a scale type which could be fabricated for display purposes if desired.

POWER

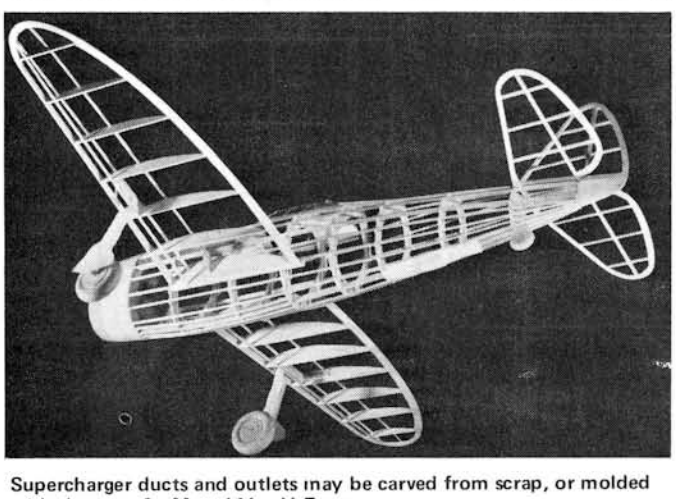
We used a single loop of 4mm Pirelli rubber, or two loops of 1/8 inch brown rubber. Heavier models might require additional power, while a very light model might need less. Experimentation seems the only answer to this question.

FLYING

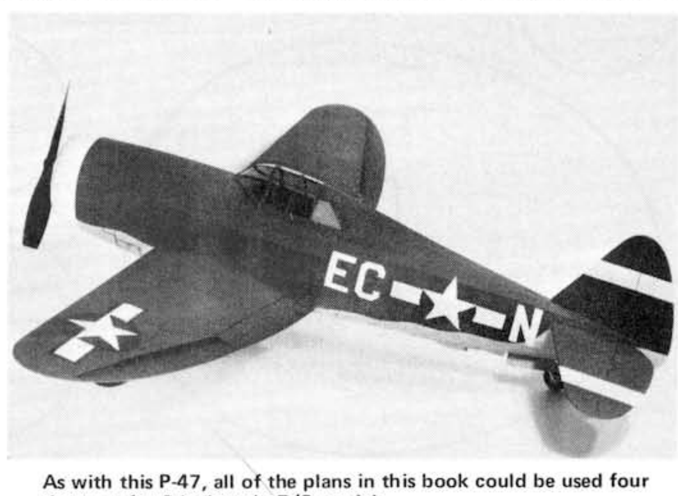
Check model carefully for warped surfaces. If any are detected, the offending part may be held over a steaming teakettle and the warped part twisted the opposite way. Upon cooling the warp should be absent. Check again later, though, as some warps seem to return with changes of temperature or humidity.

Although we are seldom able to find both, we must suggest the traditional tall grass field and calm day for test flying. Assuming the model balances close to the point shown on the side view drawing, try a few gentle hand glides. Remember to release the model smoothly, and not too fast, in a slight nose down attitude. The addition of ballast to the nose (most likely) or tail should correct any stalling or diving tendencies. If the model persists in "falling off on one wing," add a small lump of clay ballast to the opposite wing.

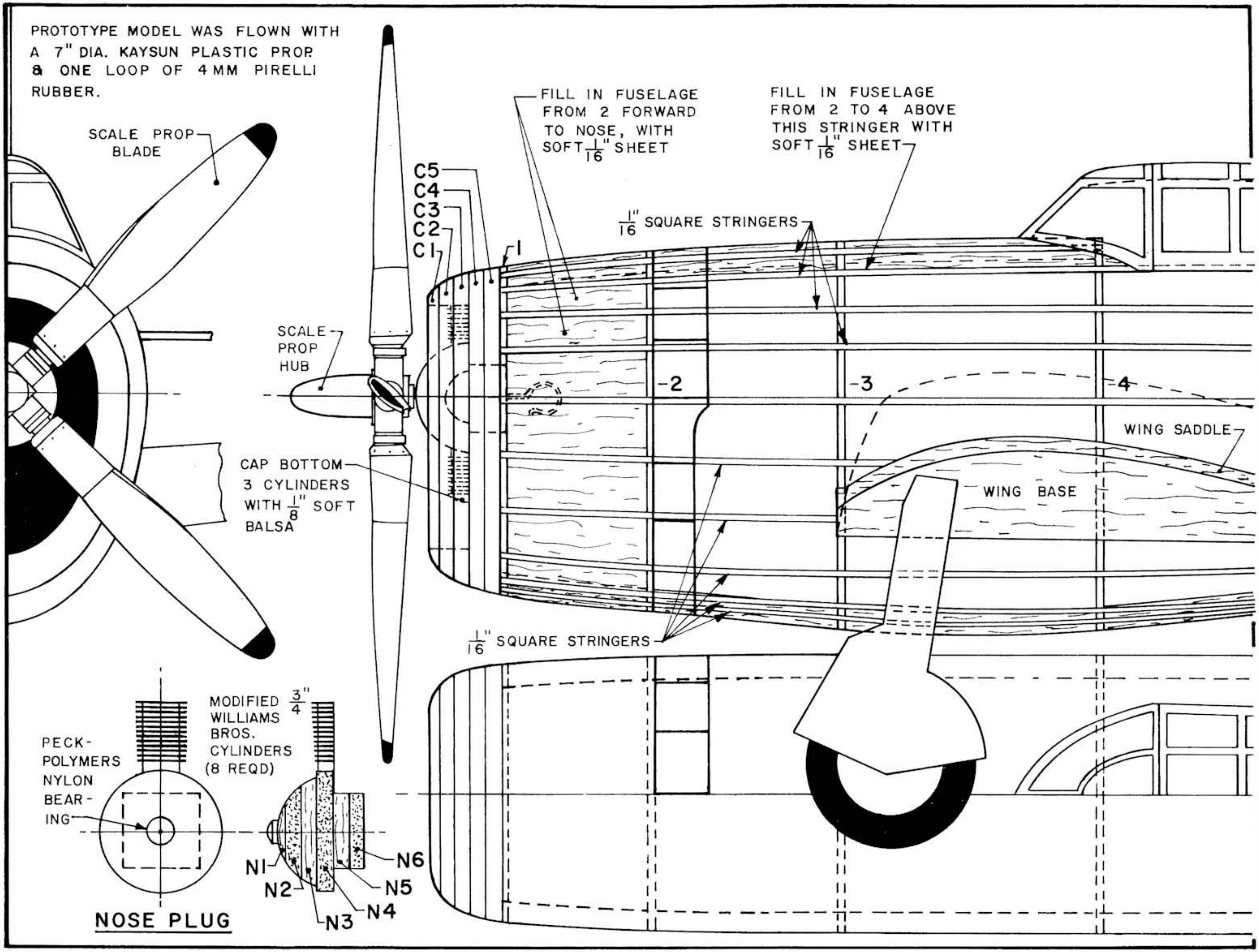
When the glide appears satisfactory, try a few turns in the rubber motor. The flight path should be smooth, with no strong tendencies in any direction. If stalling under power occurs, add a downthrust shim at the top of the thrust button. If the flight circle is too tight, or there is insufficient turn, correct with a side thrust adjustment shim. More turns are added to the rubber motor, and any needed readjustments performed. Sometimes a little bit of tail surface "tweaking" can be helpful, but should not be overdone. When all is in order, stretch wind with a mechanical winder for longest flights. ●

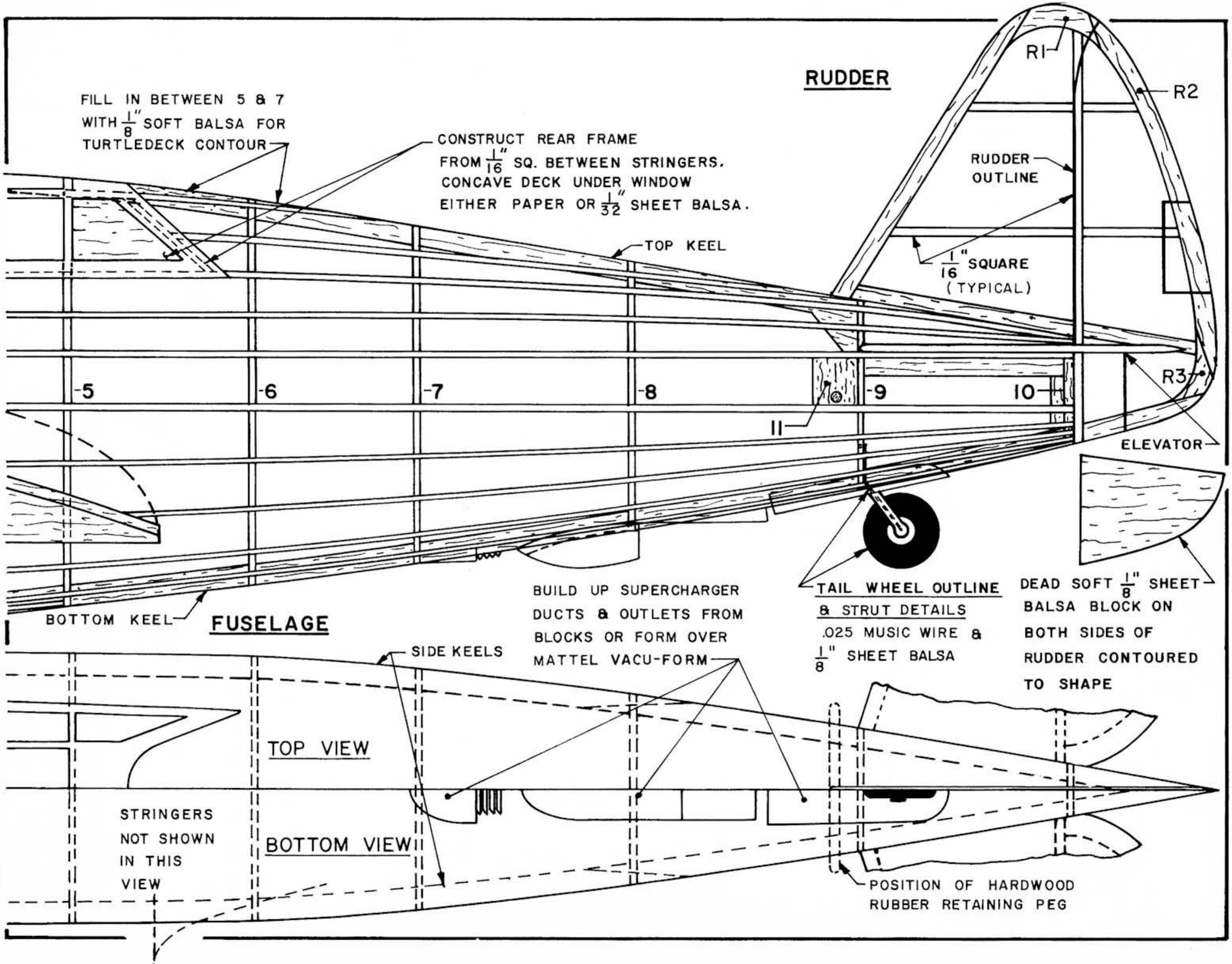


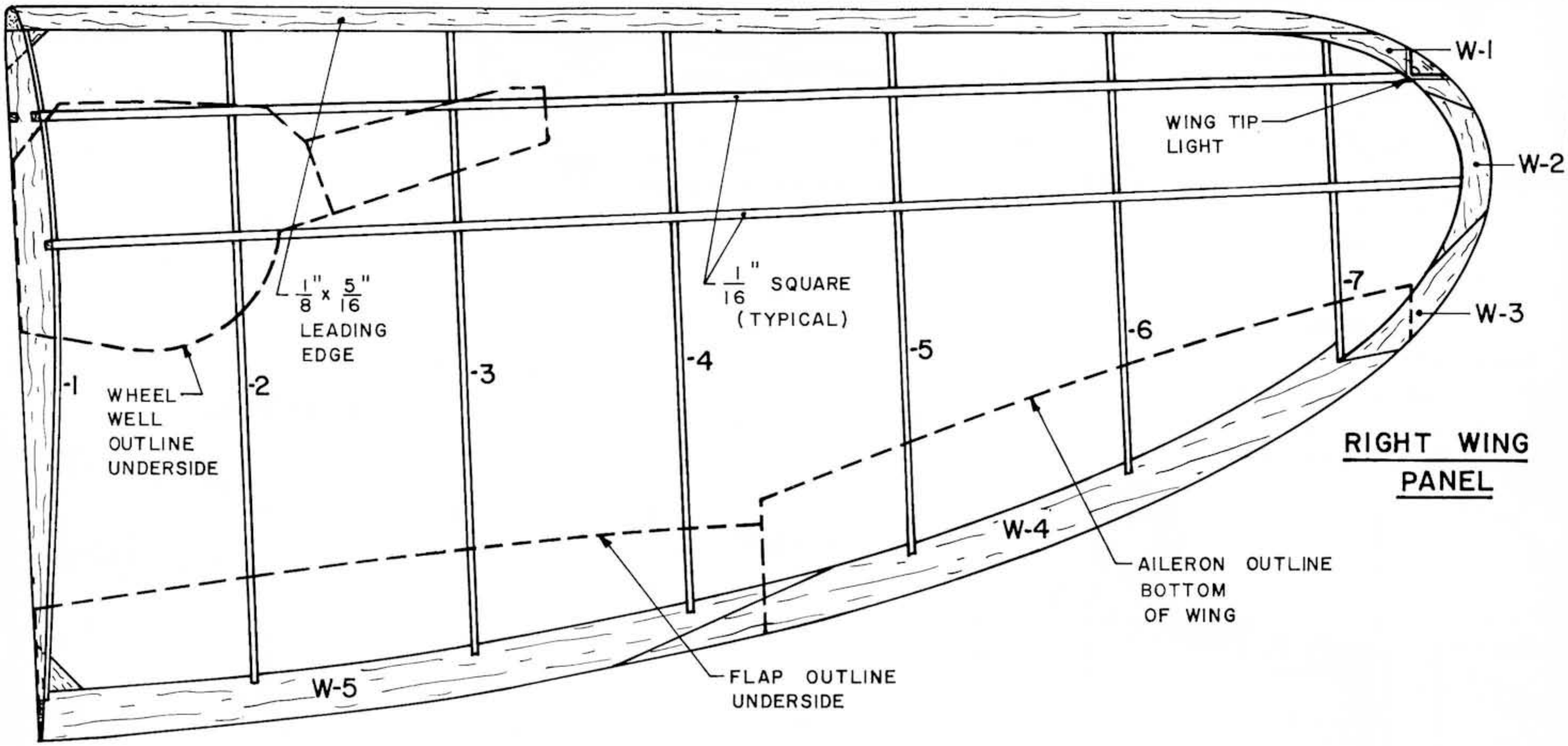
Supercharger ducts and outlets may be carved from scrap, or molded with the use of a Mattel Vac-U-Form.

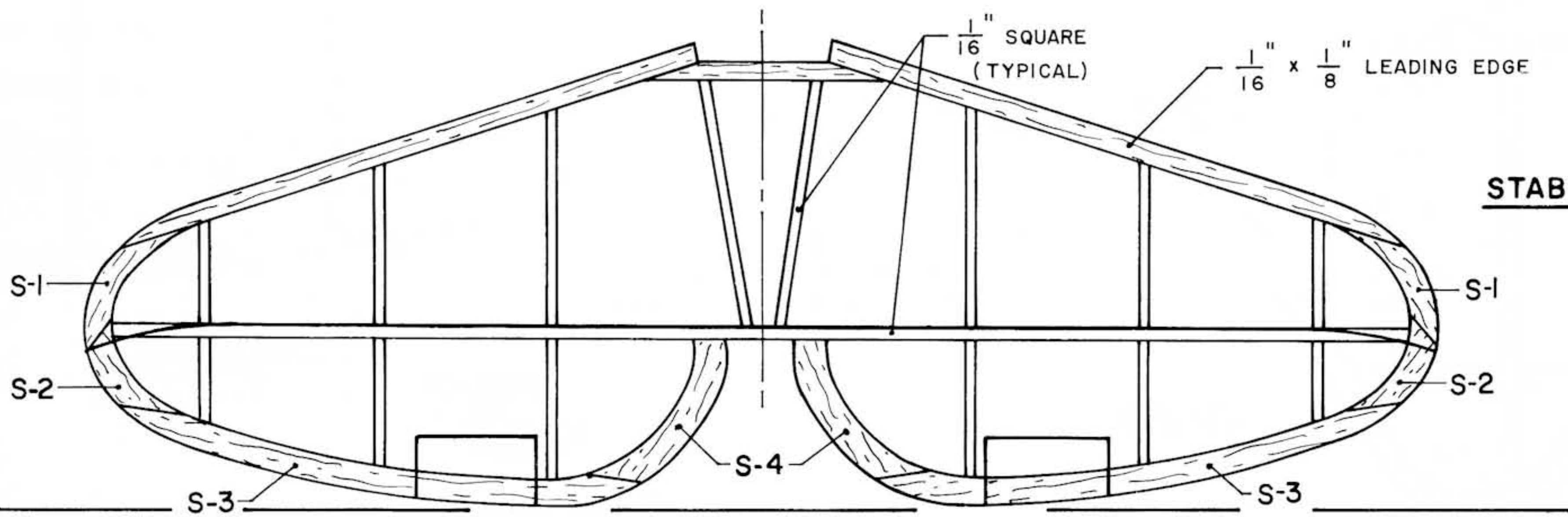


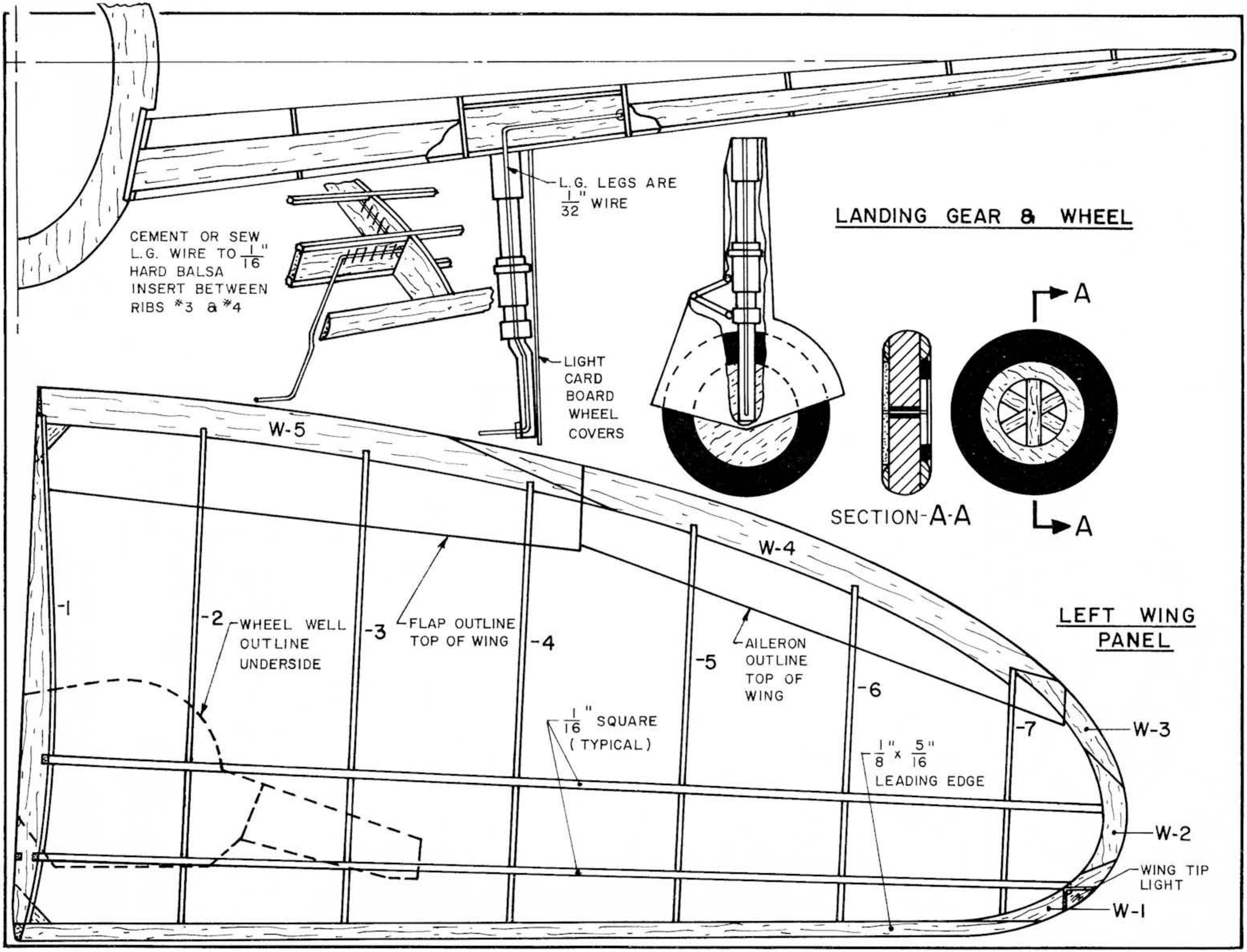

As with this P-47, all of the plans in this book could be used four times up for 2 inch scale R/C models.


PROTOTYPE MODEL WAS FLOWN WITH A 7" DIA. KAYSUN PLASTIC PROP. & ONE LOOP OF 4 MM PIRELLI RUBBER.
SCALE PROP BLADE
C5
C4
C3
C2
C1
1
FILL IN FUSELAGE FROM 2 FORWARD TO NOSE, WITH SOFT 1/16" SHEET
FILL IN FUSELAGE FROM 2 TO 4 ABOVE THIS STRINGER WITH SOFT 1/16" SHEET
1/16" SQUARE STRINGERS
SCALE PROP HUB
2
3
4
WING SADDLE
WING BASE
CAP BOTTOM 3 CYLINDERS WITH 1/8" SOFT BALSA
1/16" SQUARE STRINGERS
MODIFIED 3/4" WILLIAMS BROS. CYLINDERS (8 REQD)
PECK-POLYMERS NYLON BEARING
N1
N2
N3
N4
N5
N6
NOSE PLUG


FILL IN BETWEEN 5 & 7 WITH 1/8" SOFT BALSA FOR TURTLEDECK CONTOUR
CONSTRUCT REAR FRAME FROM 1/16" SQ. BETWEEN STRINGERS. CONCAVE DECK UNDER WINDOW EITHER PAPER OR 1/32" SHEET BALSA.
RUDDER
R1
R2
R3
RUDDER OUTLINE
1/16" SQUARE (TYPICAL)
TOP KEEL
-5
-6
-7
-8
-9
10
11
ELEVATOR
BOTTOM KEEL
FUSELAGE
BUILD UP SUPERCHARGER DUCTS & OUTLETS FROM BLOCKS OR FORM OVER MATTEL VACU-FORM
TAIL WHEEL OUTLINE & STRUT DETAILS
.025 MUSIC WIRE & 1/8" SHEET BALSA
DEAD SOFT 1/8" SHEET BALSA BLOCK ON BOTH SIDES OF RUDDER CONTOURED TO SHAPE
SIDE KEELS
TOP VIEW
BOTTOM VIEW
STRINGERS NOT SHOWN IN THIS VIEW
POSITION OF HARDWOOD RUBBER RETAINING PEG

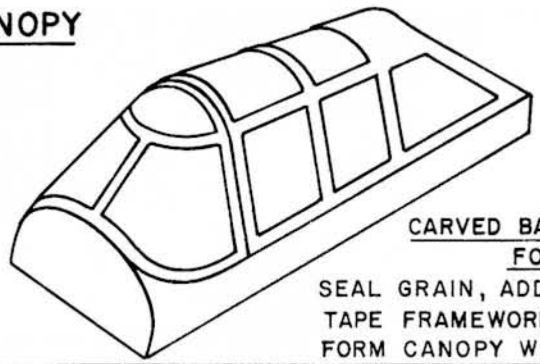

W-1
WING TIP LIGHT
W-2
1" x 5" / 8 x 16 LEADING EDGE
1" / 16 SQUARE (TYPICAL)
-7
W-3
-1
-2
-3
-4
-5
-6
WHEEL WELL OUTLINE UNDERSIDE
RIGHT WING PANEL
W-4
AILERON OUTLINE BOTTOM OF WING
W-5
FLAP OUTLINE UNDERSIDE


1" / 16 SQUARE (TYPICAL)
1" x 1" / 16 x 8 LEADING EDGE
STAB
S-1
S-1
S-2
S-2
S-4
S-3
S-3



LANDING GEAR & WHEEL
L.G. LEGS ARE 1/32" WIRE
CEMENT OR SEW L.G. WIRE TO 1/16" HARD BALSA INSERT BETWEEN RIBS #3 & #4
LIGHT CARD BOARD WHEEL COVERS
A
A
SECTION-A-A
LEFT WING PANEL
W-5
W-4
W-3
W-2
W-1
-1
-2
-3
-4
-5
-6
-7
WHEEL WELL OUTLINE UNDERSIDE
FLAP OUTLINE TOP OF WING
AILERON OUTLINE TOP OF WING
1/16" SQUARE (TYPICAL)
1/8" x 5/16" LEADING EDGE
WING TIP LIGHT

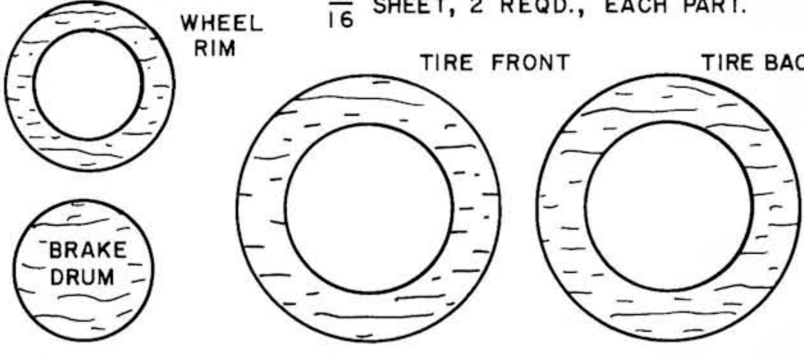
## CANOPY



CARVED BALSA COCKPIT FORM

SEAL GRAIN, ADD PAPER OR TAPE FRAMEWORK, SEAL, AND FORM CANOPY WITH VAC-U-FORM.

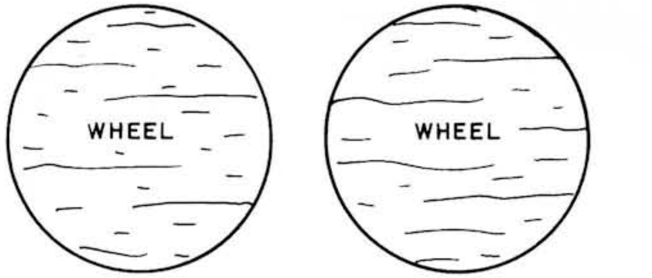
$\frac{1}{16}$" SHEET, 2 REQD., EACH PART.

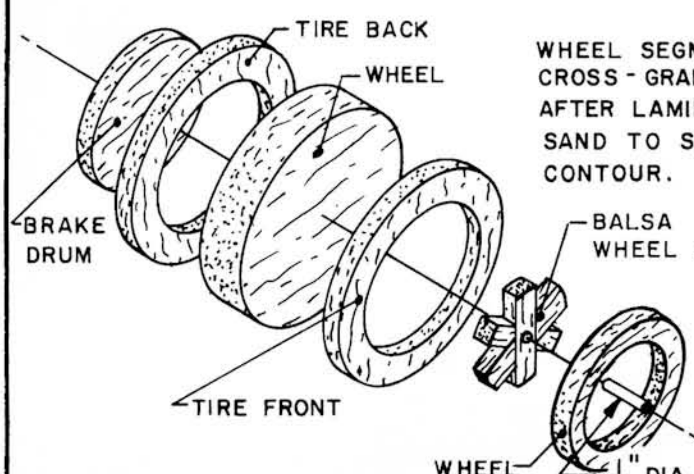



$\frac{1}{4}$" SHEET,

1 REQ'D.

EACH PART.



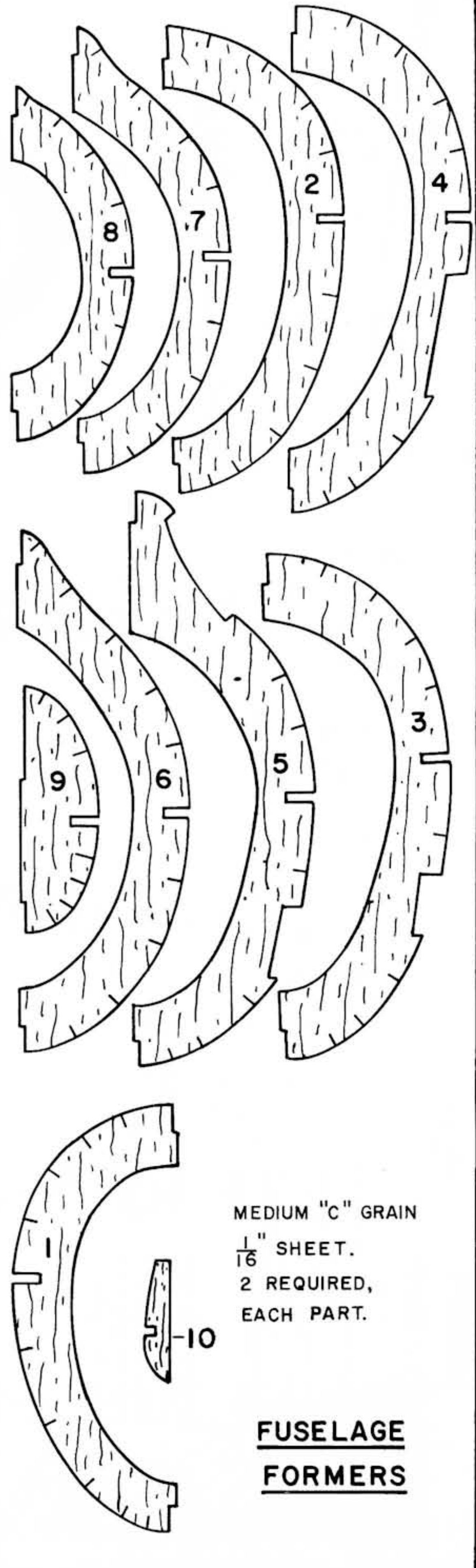

WHEEL SEGMENTS CROSS - GRAINED. AFTER LAMINATING, SAND TO SMOOTH CONTOUR.

$\frac{1}{16}$" DIA. x $\frac{1}{4}$" LONG ALUMINUM TUBE BEARINGS

## WHEEL DETAIL

(2 REQUIRED)

AFTER WHEELS ARE ASSEMBLED, SEVERAL THICK APPLICATIONS OF PRIMER ARE USED TO SEAL THE GRAIN & BUILD UP FILLETS AROUND THE SPOKES.

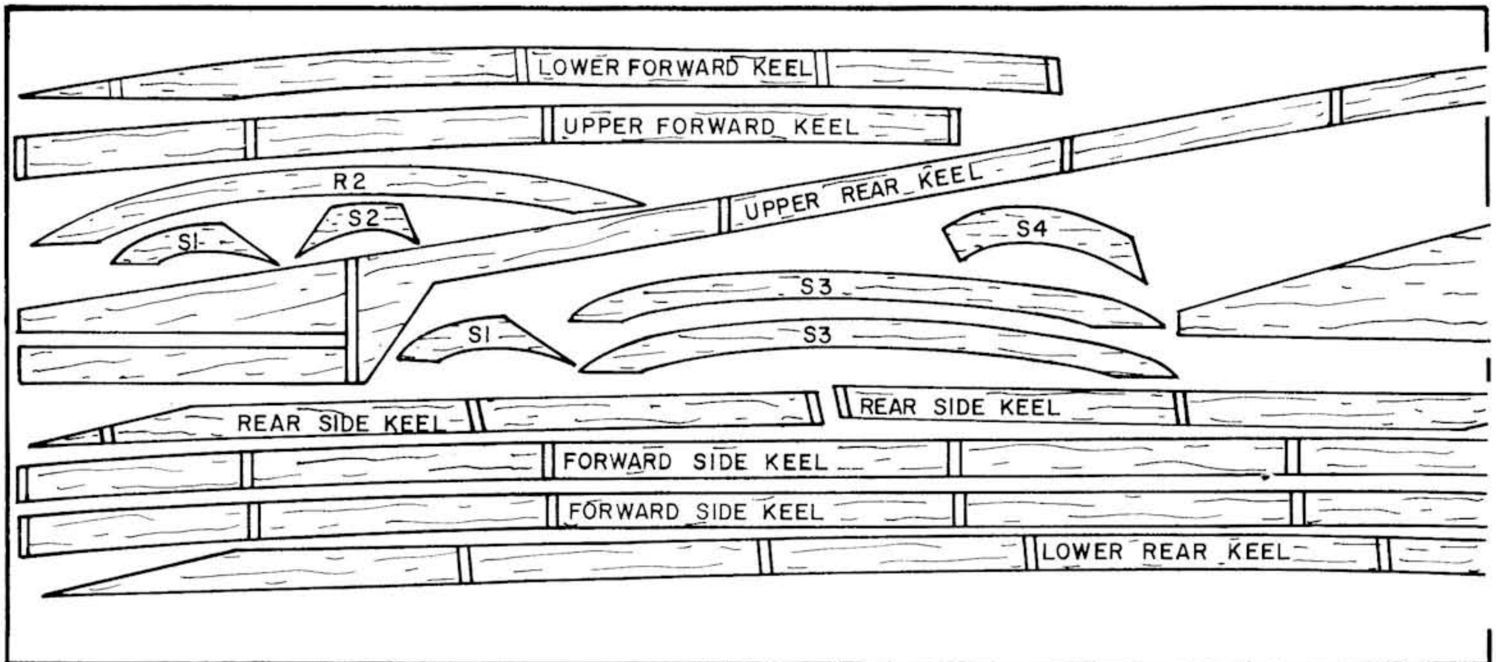


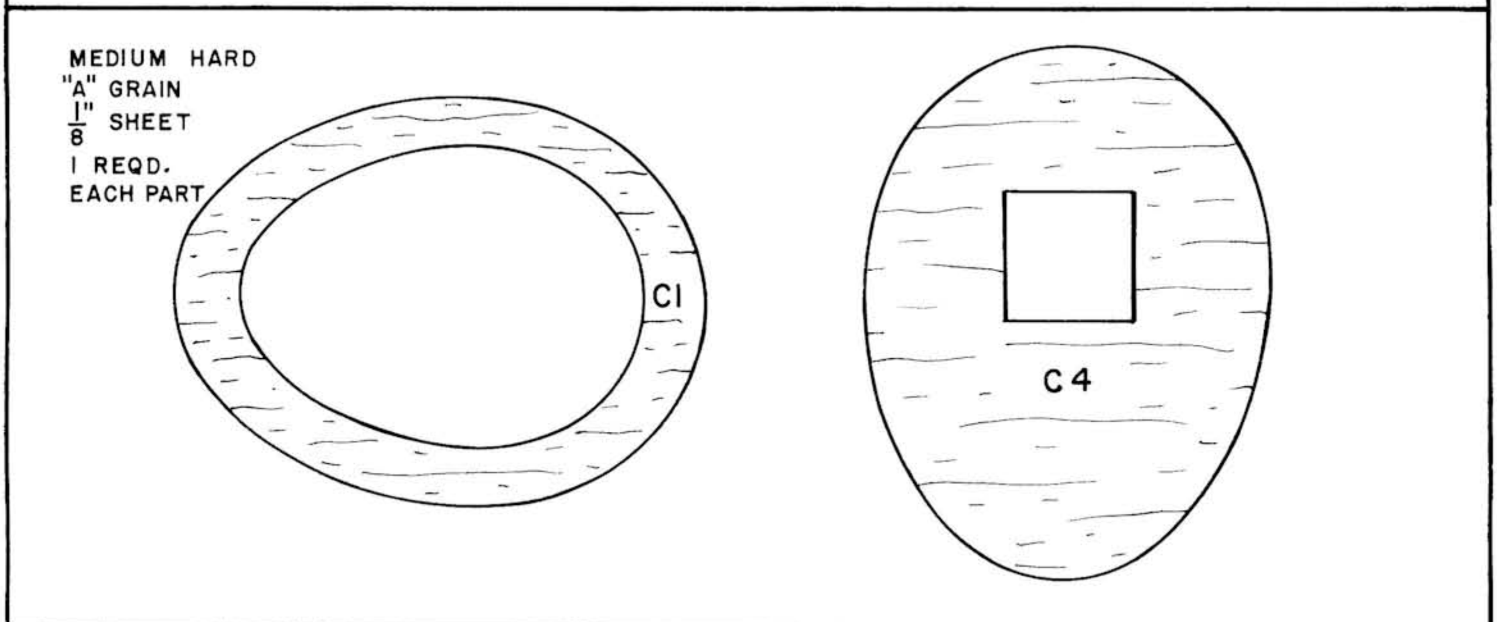

MEDIUM "C" GRAIN

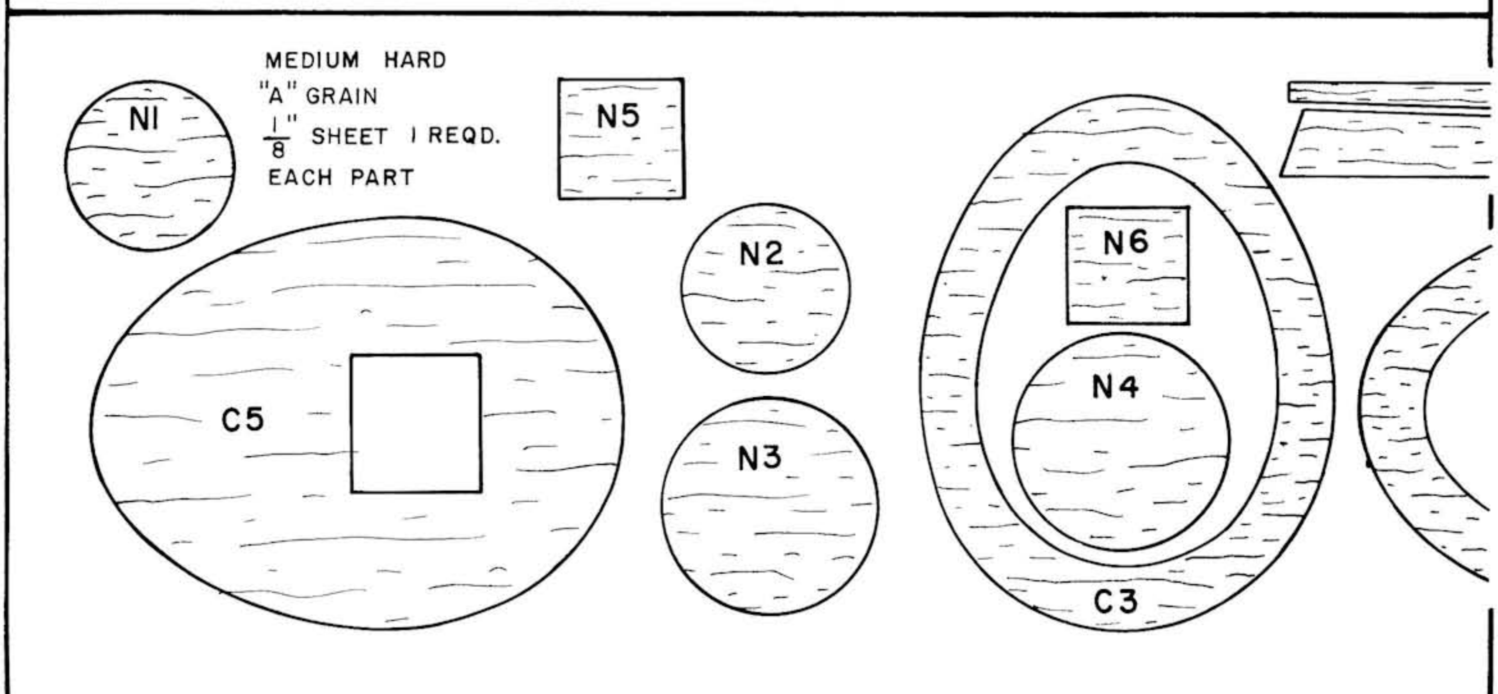
$\frac{1}{16}$" SHEET.

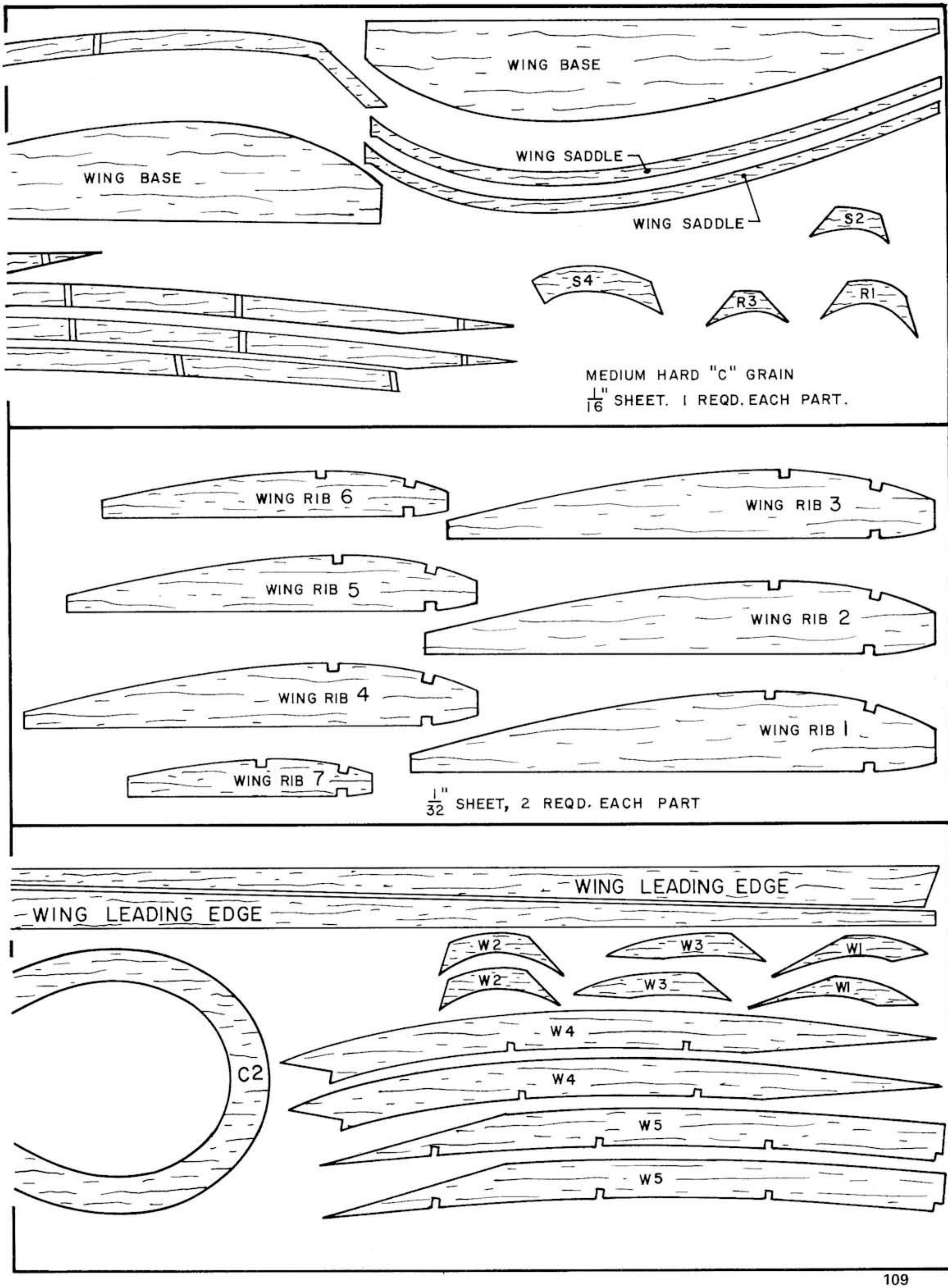
2 REQUIRED, EACH PART.

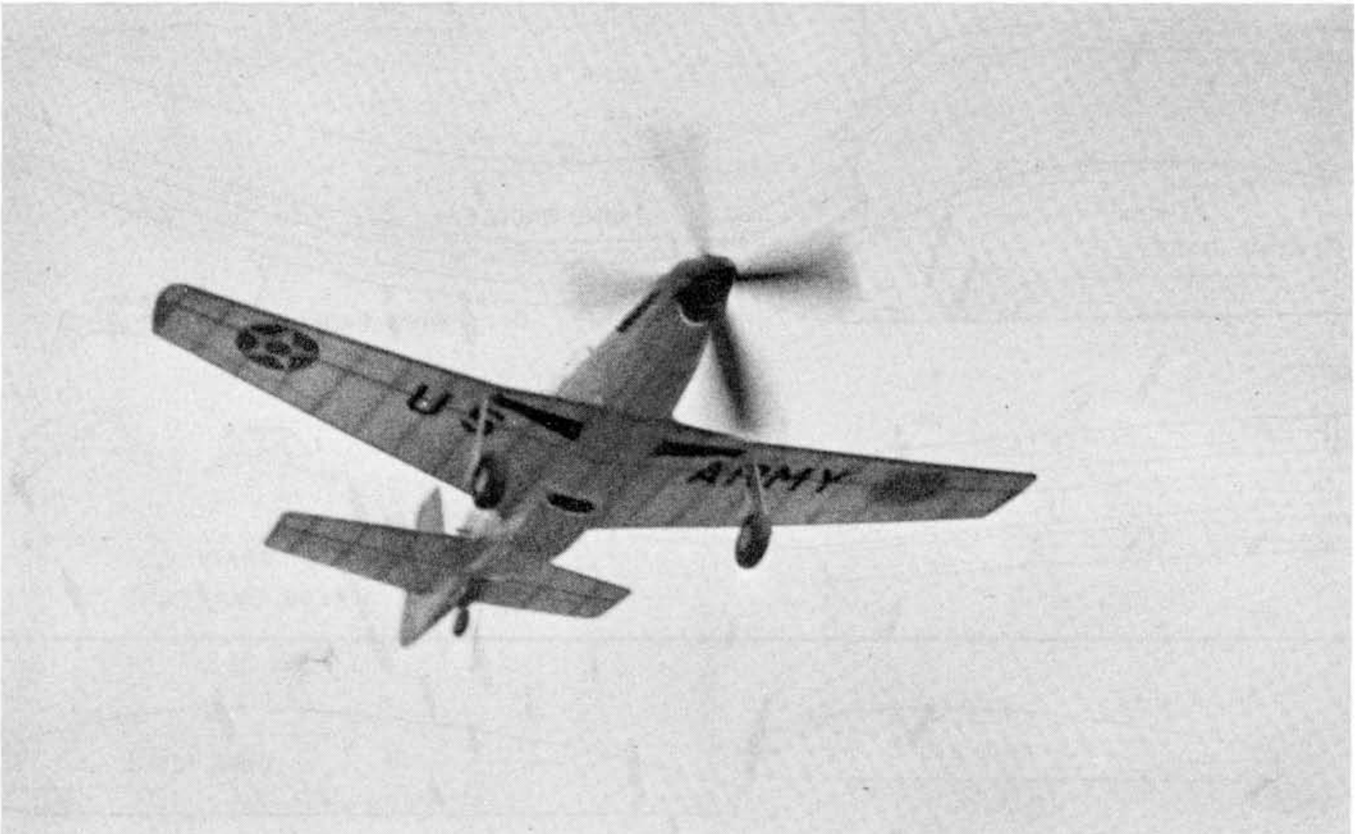
## FUSELAGE FORMERS


LOWER FORWARD KEEL
UPPER FORWARD KEEL
R2
S1
S2
UPPER REAR KEEL
S4
S3
S1
S3
REAR SIDE KEEL
REAR SIDE KEEL
FORWARD SIDE KEEL
FORWARD SIDE KEEL
LOWER REAR KEEL


MEDIUM HARD
"A" GRAIN
1/8" SHEET
1 REQD.
EACH PART
C1
C4


MEDIUM HARD
"A" GRAIN
1/8" SHEET 1 REQD.
EACH PART
N1
N5
N2
N6
C5
N3
N4
C3


WING BASE
WING BASE
WING SADDLE
WING SADDLE
S2
S4
R3
R1
MEDIUM HARD "C" GRAIN
1/16" SHEET. 1 REQD. EACH PART.
WING RIB 6
WING RIB 3
WING RIB 5
WING RIB 2
WING RIB 4
WING RIB 1
WING RIB 7
1/32" SHEET, 2 REQD. EACH PART
WING LEADING EDGE
WING LEADING EDGE
W2
W3
W1
W2
W3
W1
W4
C2
W4
W5
W5




One of the best fliers of the models presented in this book, this P-51 puts in flights that are consistently over a minute outdoors. Stabilizer area and wing dihedral were increased to improve stability.

# P-51B MUSTANG

By CLARENCE MATHER

● The smooth curve of the Mustang's bullet nose, the sharp belly curve of the coolant radiator, and the squared off fin, stabilizer, and wing are really incongruous. Yet the whole seems harmonious. Mustangs look as if they can get up and go . . . and they do just that! The P-51B version modeled here was the first to use the English Merlin engine. That gave the Mustang high altitude capability; in addition to speed, long range, maneuverability, and strength. Mustangs were used in all theaters in World War II, and in a variety of roles, with much success. One of the more famous of the B versions was Don Gentile's Shangri La, with thirty victories.

The P-51 was designed and built in 1940. Originally, North American Aviation's president, "Dutch" Kindelberger, had been asked to build P-40's for England. North American had been considering fighter design and felt that they could come up with a better plane in the same time that it would take them to tool up for the P-40. Designer Edgar Schmued went to work, and the P-51 resulted. He utilized a radical laminar flow airfoil for low drag. The Mustang was one of the most popular and best performing fighters of the war.

The model presents a fine appearance on the ground and in the air. Flights exceed a minute's duration quite easily and show fair stability. Being a short-coupled low-winger, there is not a lot of inherent stability. The stabilizer was enlarged, dihedral increased, and the balance point brought well forward for additional stability. All flights have been outdoors, under breezy conditions.

For good duration, keep the model light by using medium grade balsa, thin stringers, built up wheels, and thin coats of dope. Ours weighs just over three quarters of an ounce empty.

Blades of the big flying prop are built up from sheet stock and wet-shaped around a tin can. Colored tissue was used to help save all possible weight. Performance proves it paid off.

Pre-bend the stringers so that they conform to the fuselage curves. They will then slip into place without warping the rest of the fuselage. Do not notch the formers or ribs until they are in position on the fuselage and wing. Sight along spar and stringer marks when notching so that errors in their positions can be corrected. Considerable care was used in drawing the parts, but it is very difficult to trace, cut out, and glue such parts into position without some deviations. The formers are drawn slightly oversize to allow for some corrections.

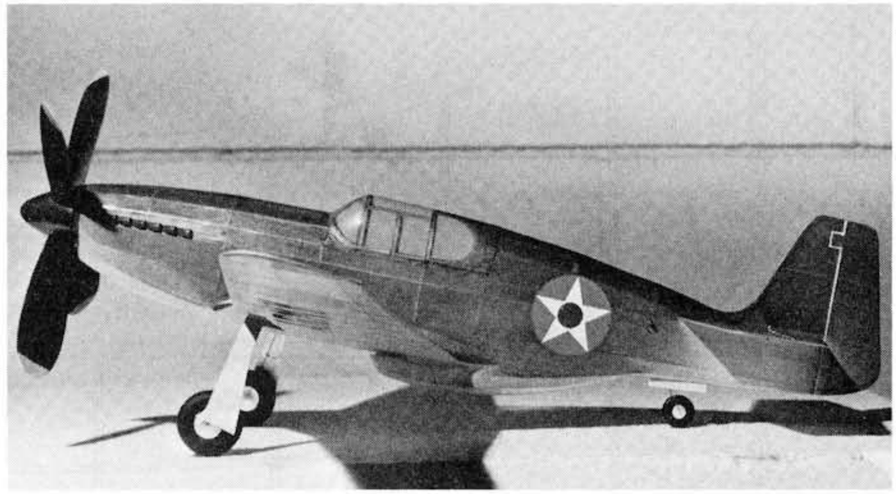
When assembling the fuselage, leave off E-1, E-2, and E-3. Fill in areas around the nose and the rear motor peg with 1/32 sheet as shown. Complete the wing, including covering, and glue in place on the fuselage. Glue E-1 to the wing and add some of the coolant radiator stringers. Then place E-2 and E-3 in position on the stringers. The front part of the radiator floats free of the wing making it awkward to construct. Small amounts of sheet between the stringers, where the rear of the radiator meets the rest of the fuselage, will facilitate covering.

If it is planned to shrink the tissue on the fin and stabilizer, it would be best to make them 3/32 thick rather than 1/16 as indicated. Ours is shrunk and doped and has developed slight warps. Twisting over a steam bath removes the warps but it is marginal. Cut strips 1/16 x 3/32 from sheet using a metal straight edge guide.

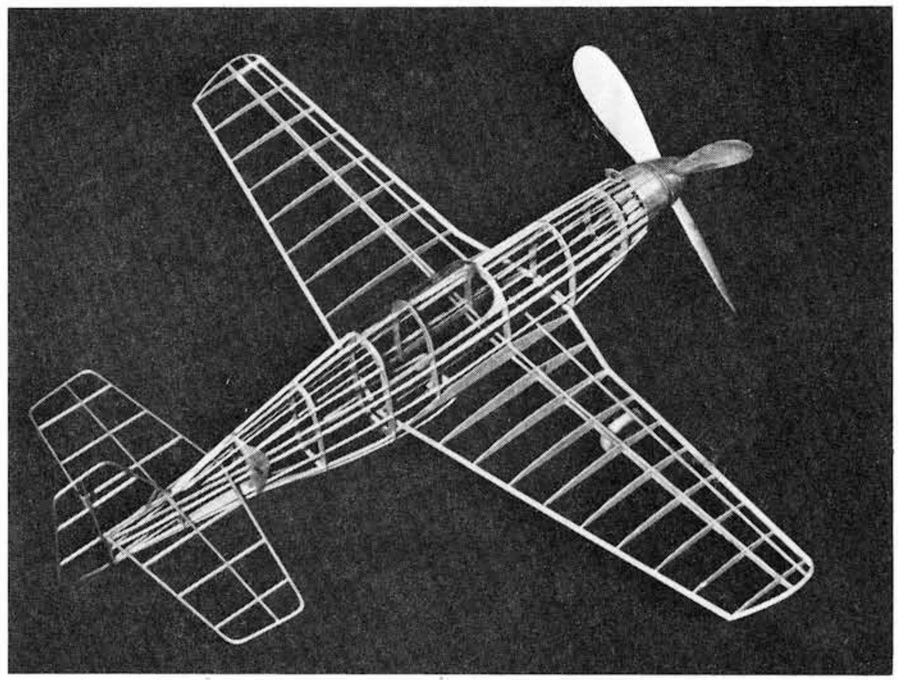
Glue the fin and the stabilizer lightly into position so they can be cut free and repositioned if necessary. Leave the fuselage area above the stabilizer uncovered until test flights are completed and no more adjustments are needed. Be sure to build in the angles shown, including the left wing wash-in. Place at least a 1/16 balsa shim between the top of the nose plug and the fuselage for down thrust before any flights are made! Use a 10 inch loop of 1/8 or 5/32 Pirelli rubber for testing, and launch over grass or other soft surface. The model should be slightly nose heavy with this short motor. As trimming progresses, longer motors can be used, which will weight the tail.

The original model was spray-doped with thin, colored nitrate dope. It was plasticized with ten drops of castor oil per ounce of dope. It was then thinned, two parts thinner to one of dope. If butyrate dopes are used, tricresyl phosphate (TCP) should be used for plasticizer.

Profile Publications is a good source of plans and particularly coloration. In the U.S.A., they are sold by J.W.C. Aeronautica, 7506 Clybourn Ave., Sun Valley, Calif. 91352. Aeromodeler had excellent detailed plans that include the B version. Their address is: Model and Allied Pulbication LTD. 13/35 Bridge St., Hemel Hempstead, England. ●

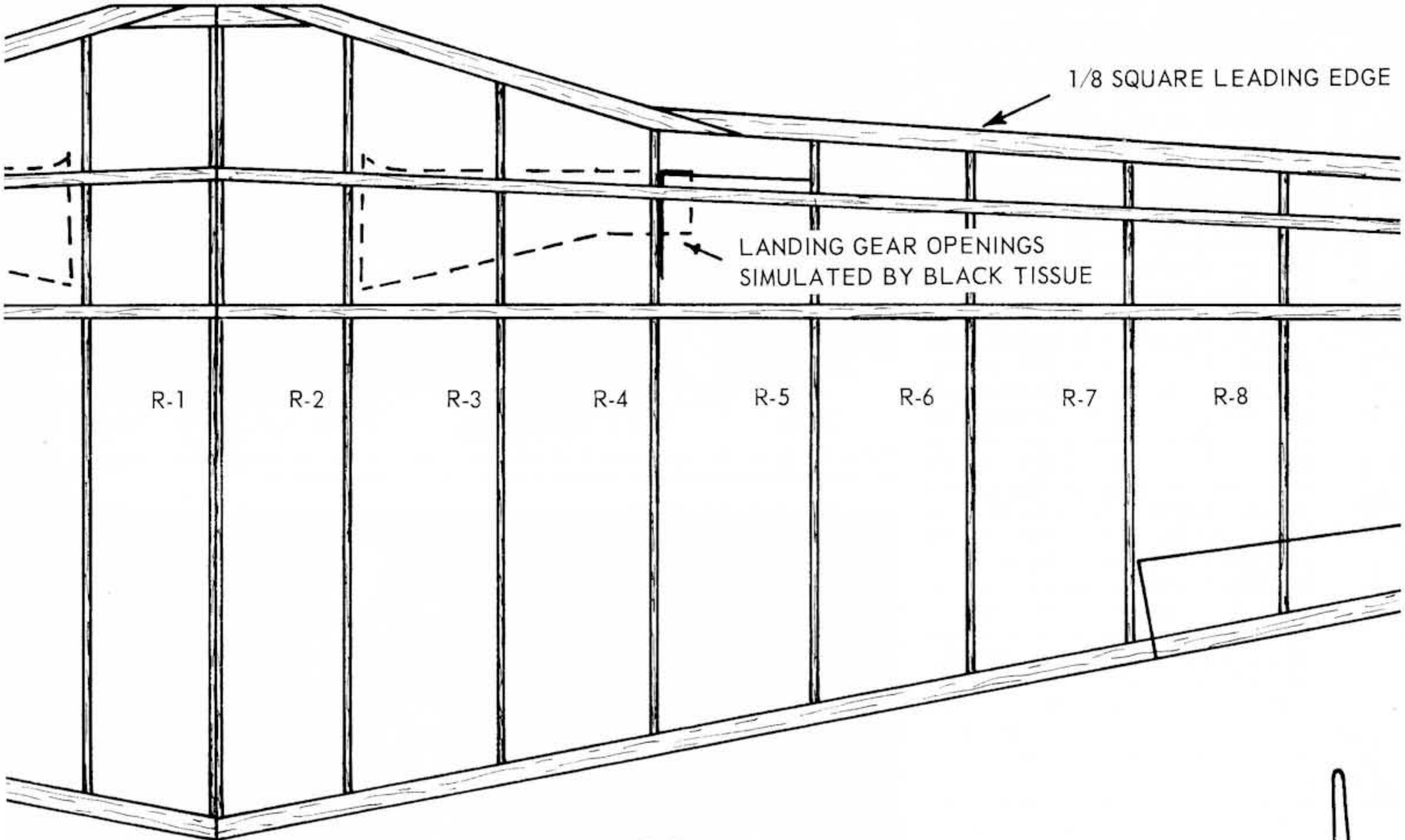


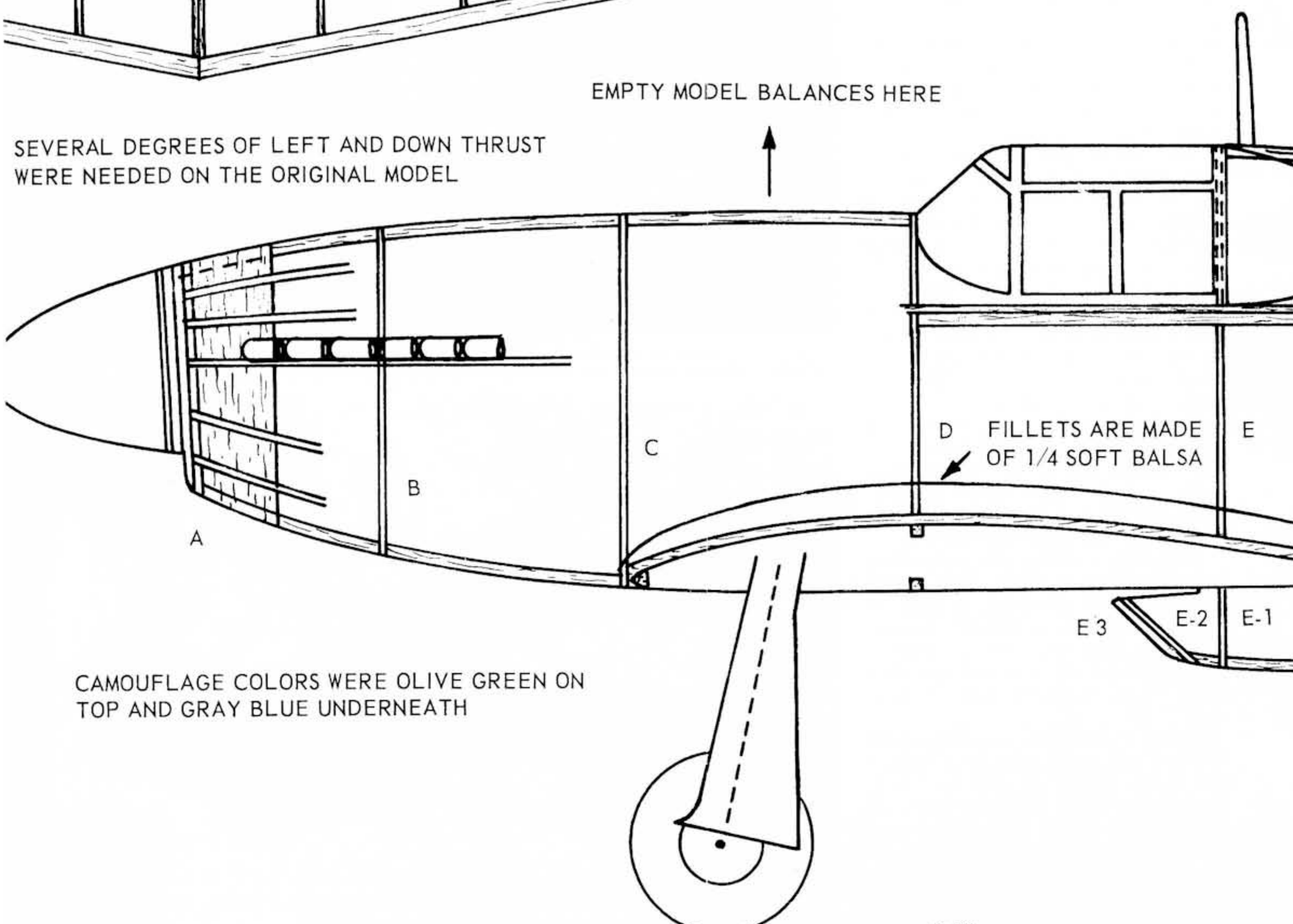
**Profile shot of the Mustang shows off its well-known lines. The B model is often overlooked as the later, bubble canopied types are still flying at many unlimited air races.**



**Secret to the success of the author's many flying scale models is summed up in this photo. The extremely light airframe not only performs better, it doesn't hit as hard in a collision!**

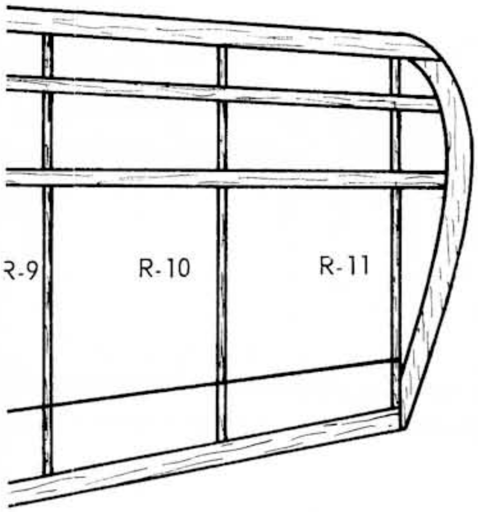
**In a different approach to control surface marking, Clarence has used white lines. They do show up!**

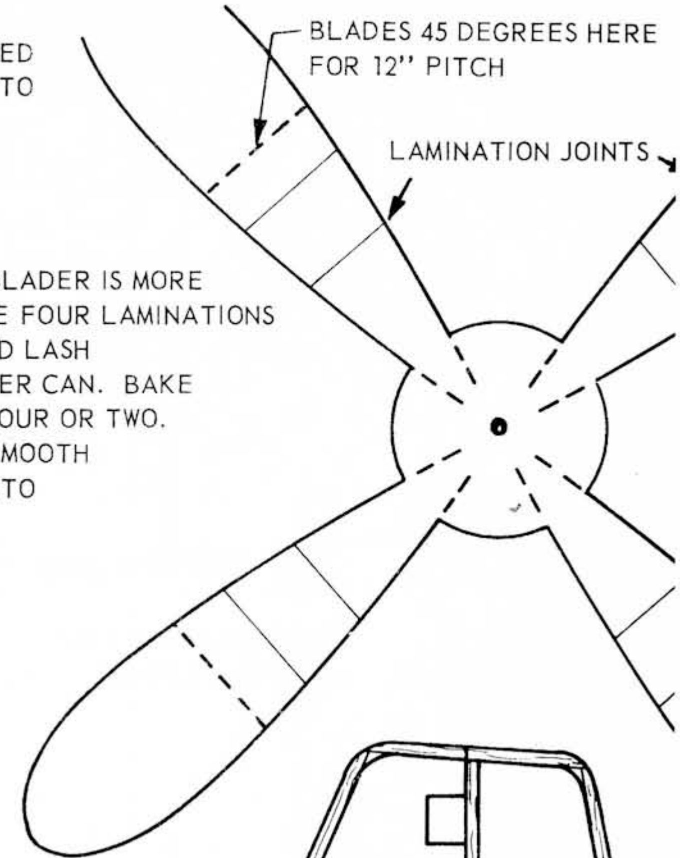

1/8 SQUARE LEADING EDGE
LANDING GEAR OPENINGS
SIMULATED BY BLACK TISSUE
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8


EMPTY MODEL BALANCES HERE
SEVERAL DEGREES OF LEFT AND DOWN THRUST
WERE NEEDED ON THE ORIGINAL MODEL
A
B
C
D
FILLETS ARE MADE
OF 1/4 SOFT BALSA
E
E 3
E-2
E-1
CAMOUFLAGE COLORS WERE OLIVE GREEN ON
TOP AND GRAY BLUE UNDERNEATH

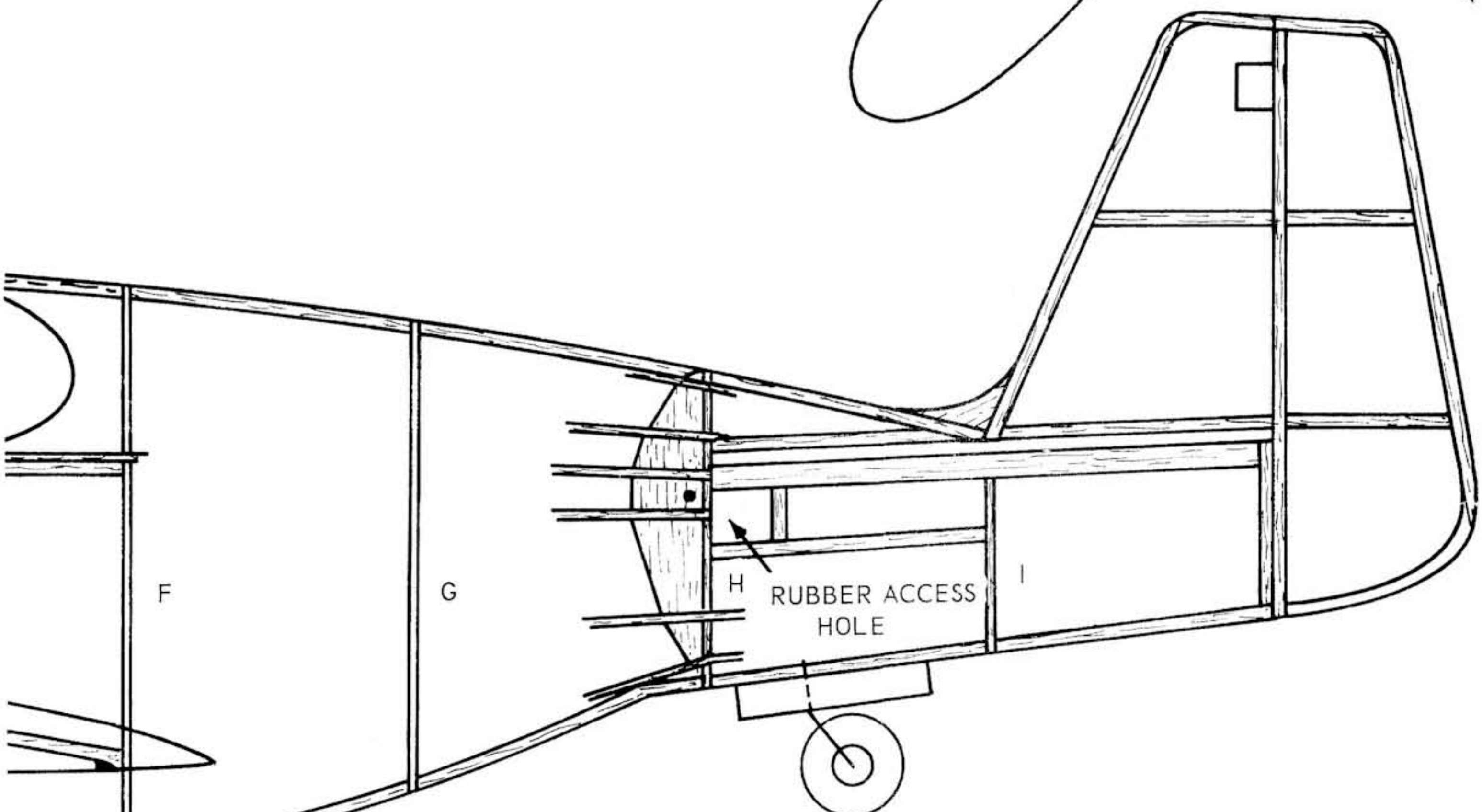
P-51

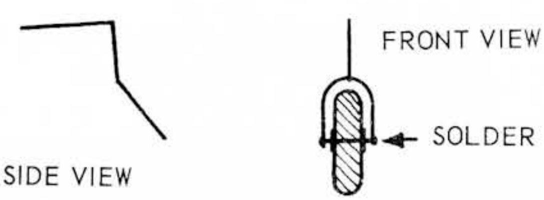
MODEL FLIES WELL ON A SQUARE TIPPED SEVEN INCH PLASTIC PROP CUT DOWN TO SIX AND A HALF INCHES



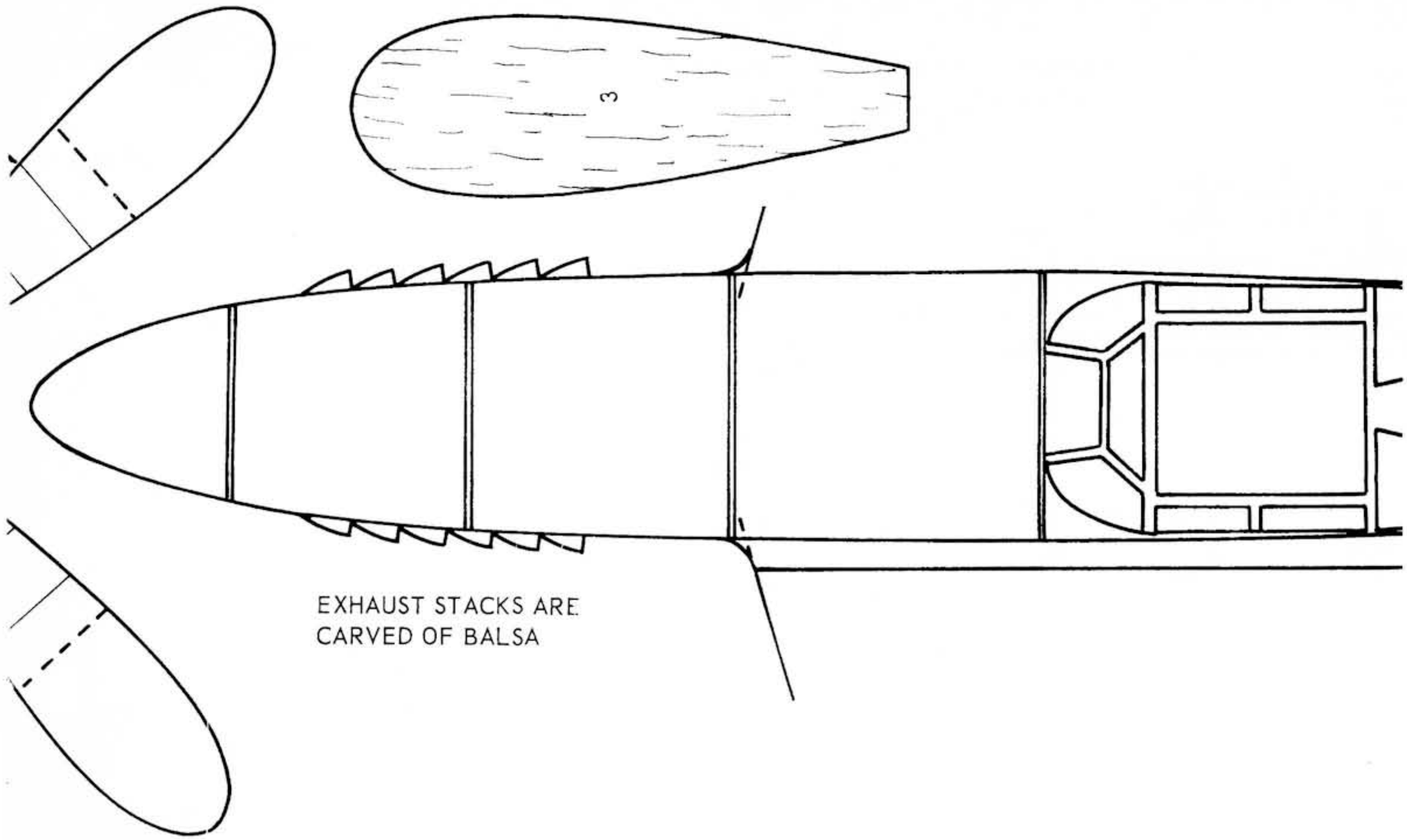



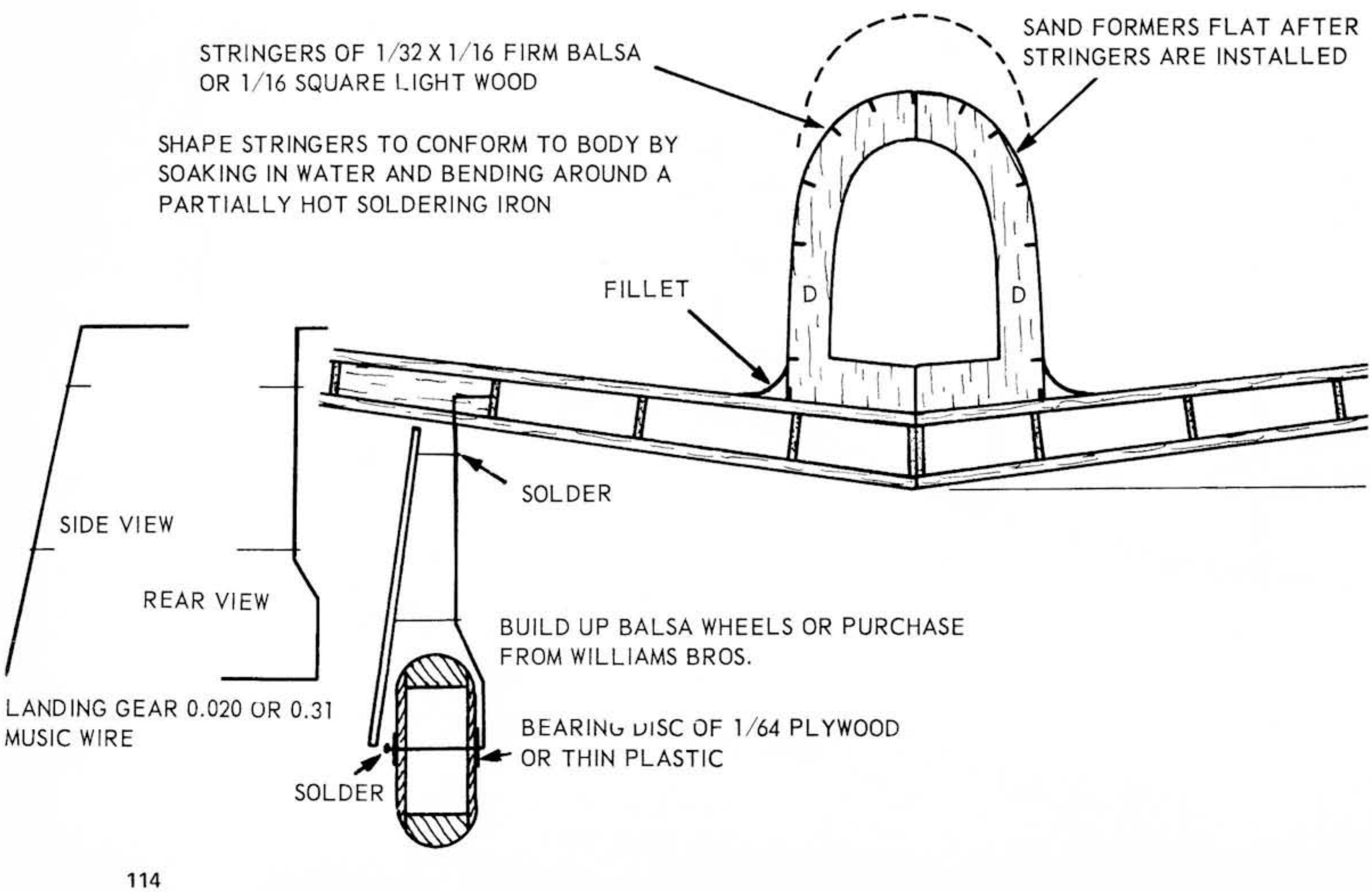

A BUILT UP BALSA FOUR BLADER IS MORE REALISTIC. ASSEMBLE THE FOUR LAMINATIONS WITH THIN WHITE GLUE AND LASH TO AN EIGHT INCH DIAMETER CAN. BAKE AT 200 DEGREES FOR AN HOUR OR TWO. SHAPE THE BLADES TO A SMOOTH AIRFOIL. CUT GROOVES INTO SPINNER DISC TO ADMIT BLADES AT THE ANGLE INDICATED. GLUE SECURELY AND ADD THE FRONT PART OF THE SPINNER

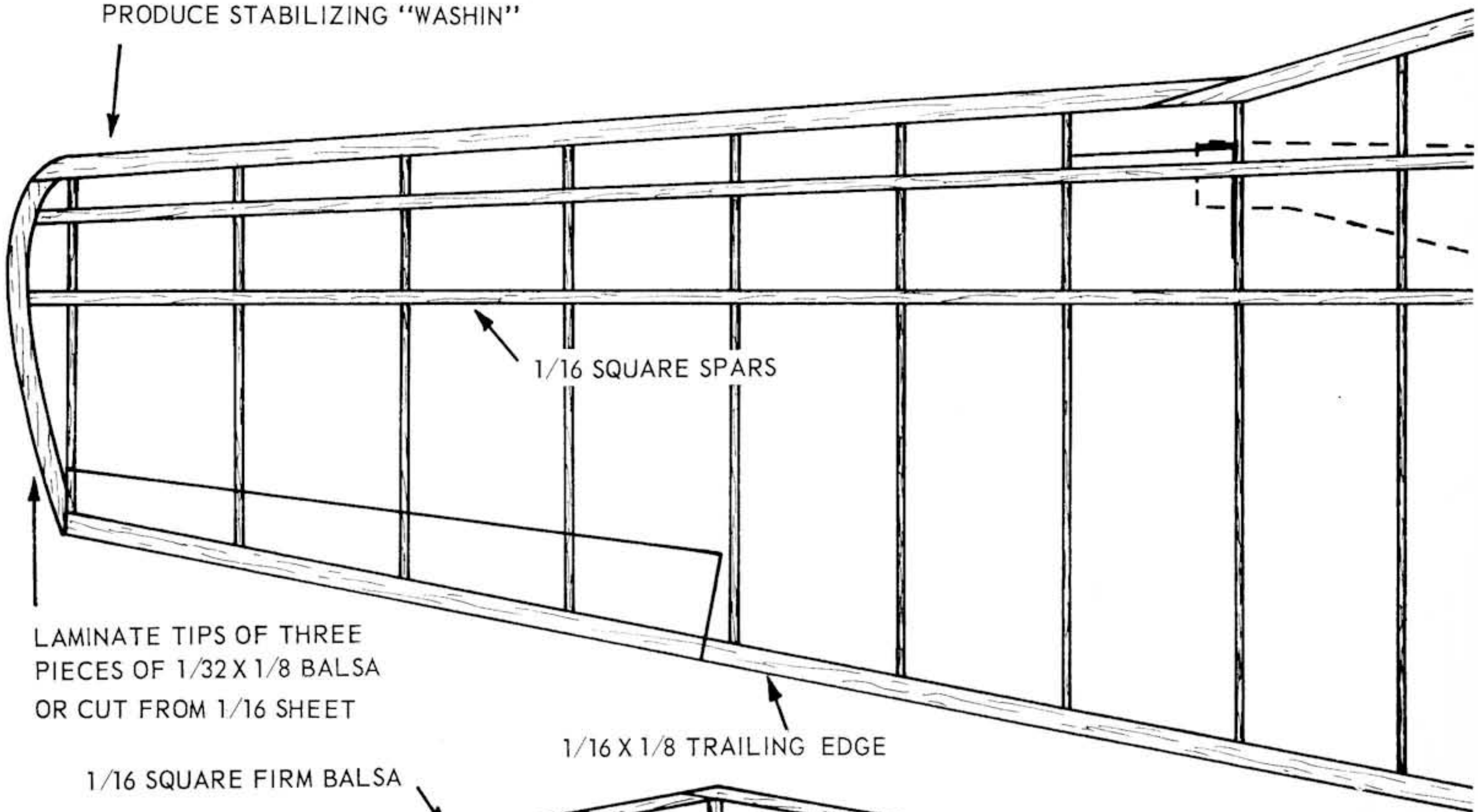


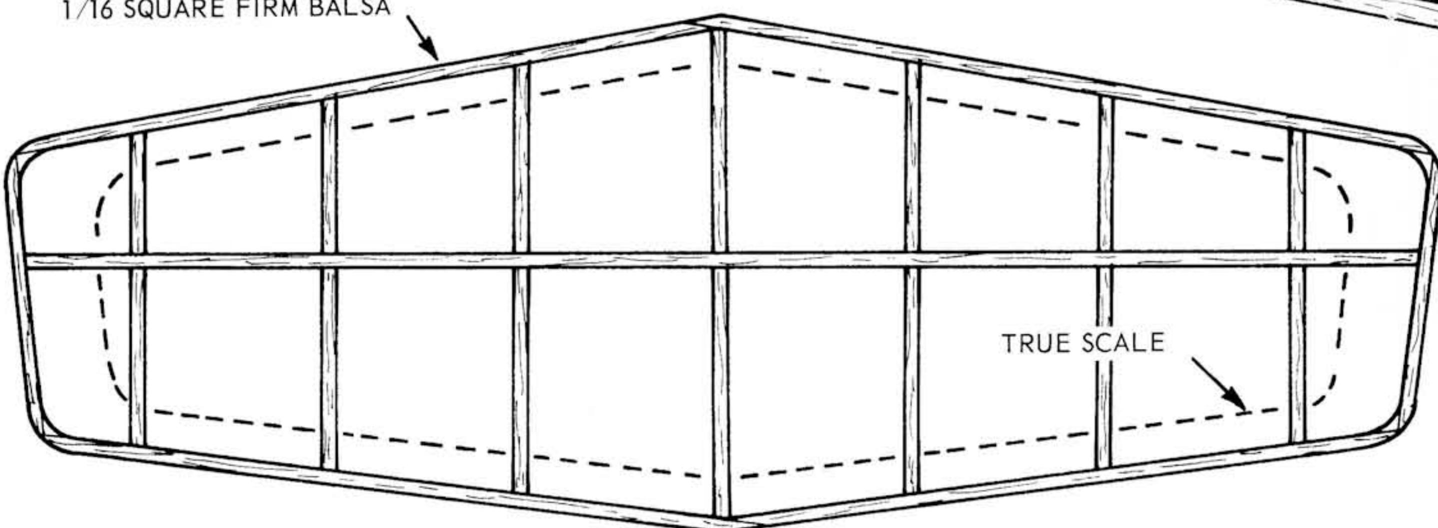




TAIL WHEEL ASSEMBLY
.016 MUSIC WIRE


3
EXHAUST STACKS ARE
CARVED OF BALSA


STRINGERS OF 1/32 X 1/16 FIRM BALSA
OR 1/16 SQUARE LIGHT WOOD
SAND FORMERS FLAT AFTER
STRINGERS ARE INSTALLED
SHAPE STRINGERS TO CONFORM TO BODY BY
SOAKING IN WATER AND BENDING AROUND A
PARTIALLY HOT SOLDERING IRON
FILLET
D
D
SOLDER
SIDE VIEW
REAR VIEW
BUILD UP BALSA WHEELS OR PURCHASE
FROM WILLIAMS BROS.
LANDING GEAR 0.020 OR 0.31
MUSIC WIRE
BEARING DISC OF 1/64 PLYWOOD
OR THIN PLASTIC
SOLDER



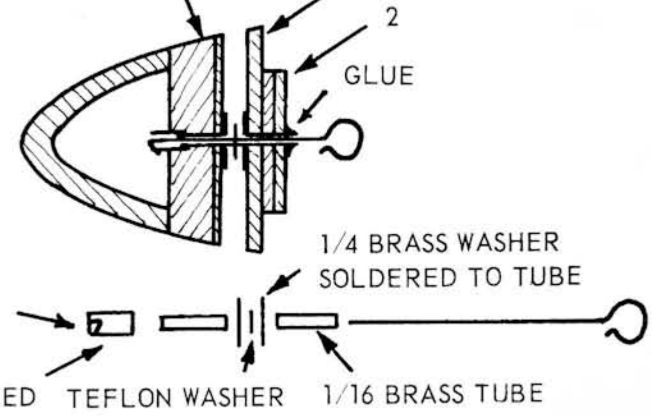



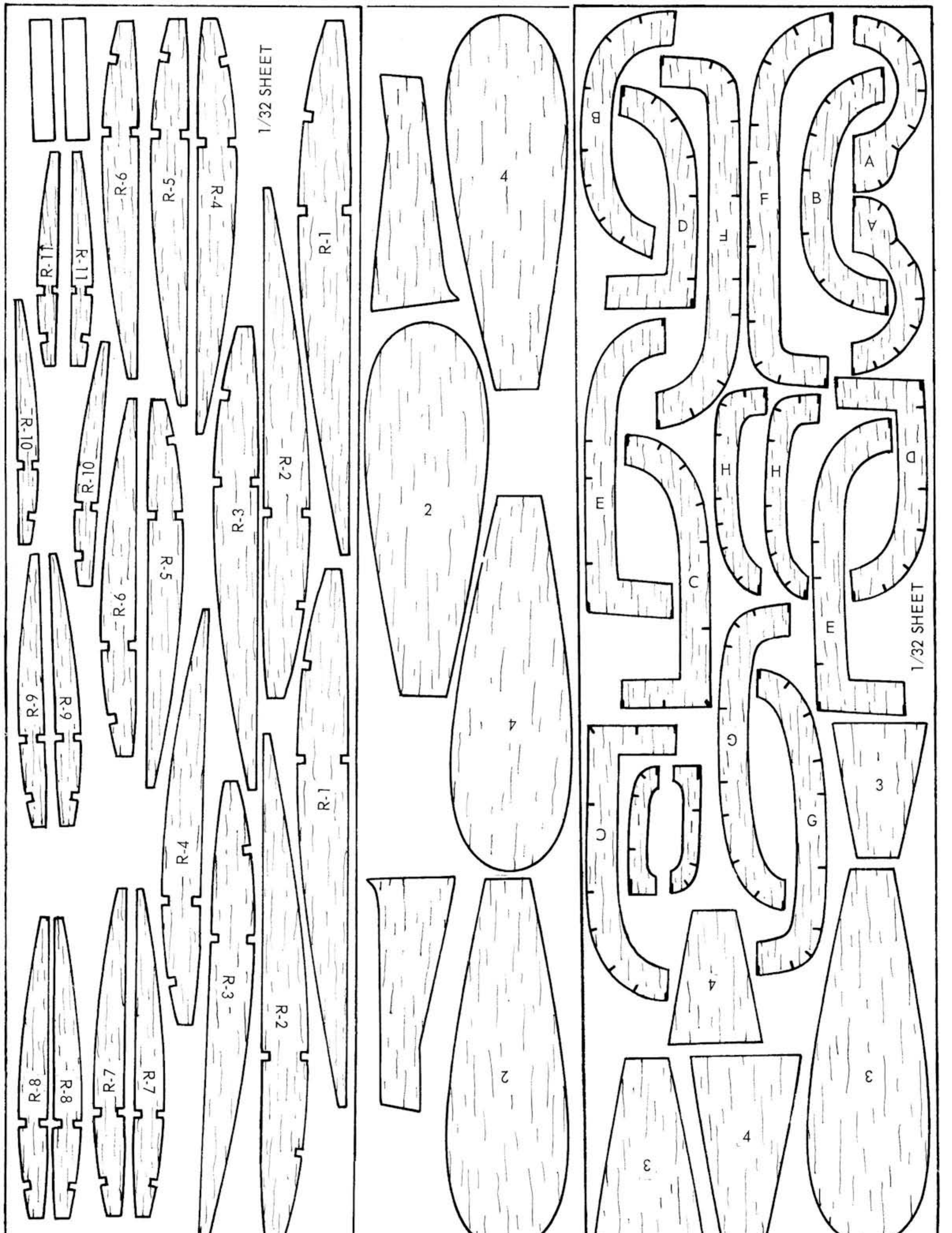

NORTH AMERICAN MUSTANG
P-51B

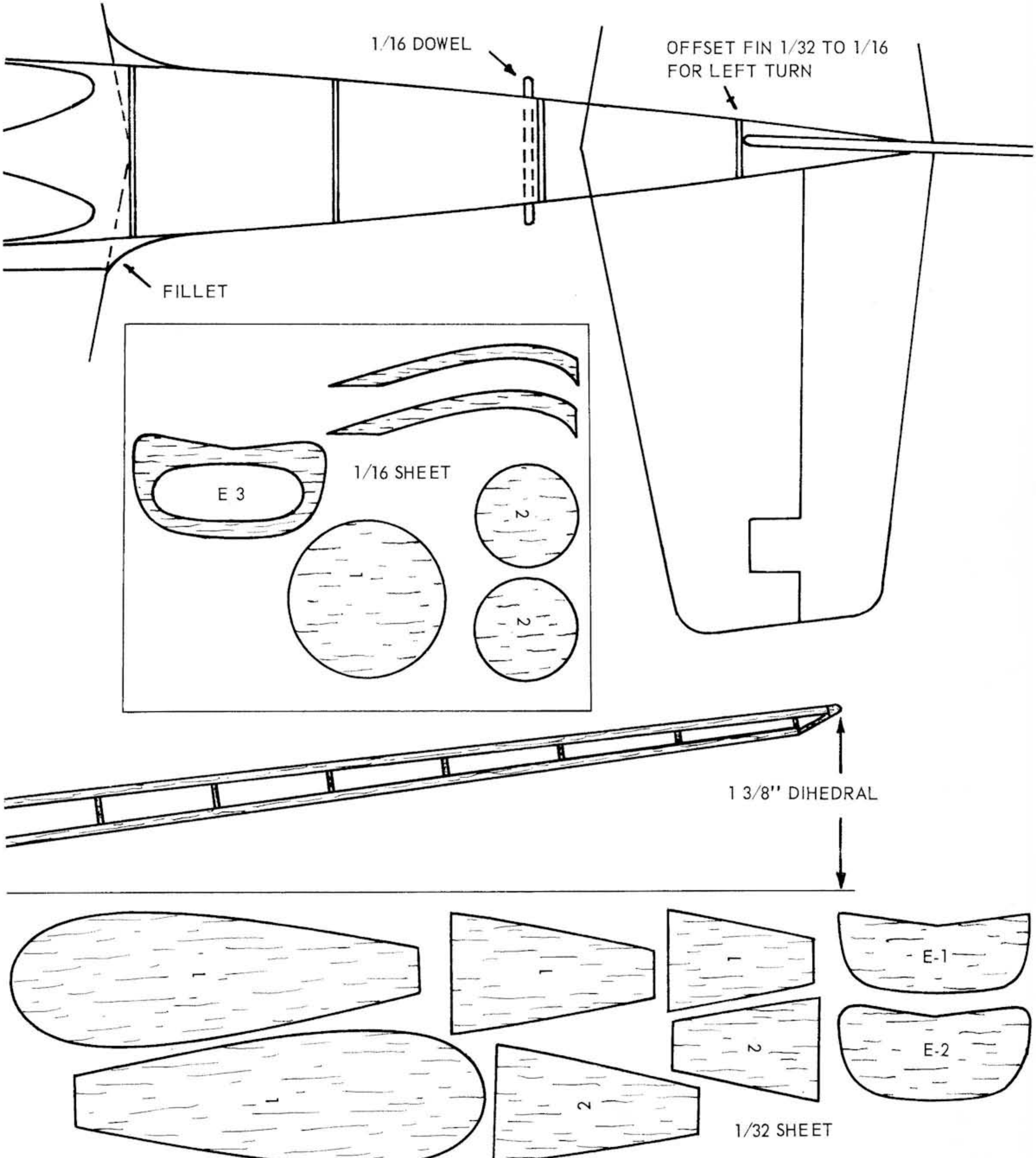
SCALE 1/2" 1'

*C Mather*

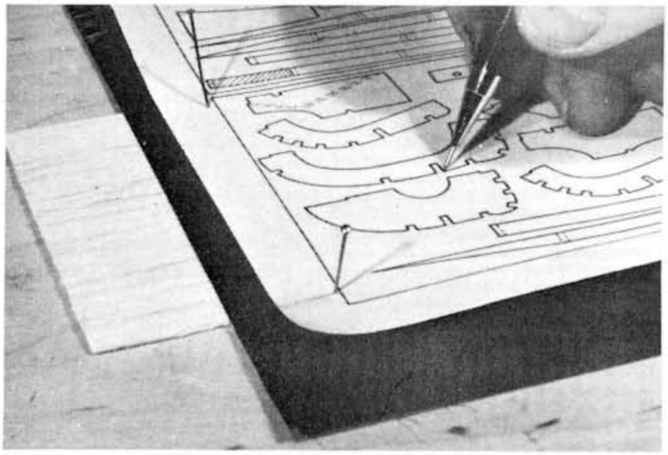
MODEL FLIES ON 1/8 TO 1/4 PIRELLI DEPENDING
UPON THE PROPELLOR TYPE AND MODEL WEIGHT



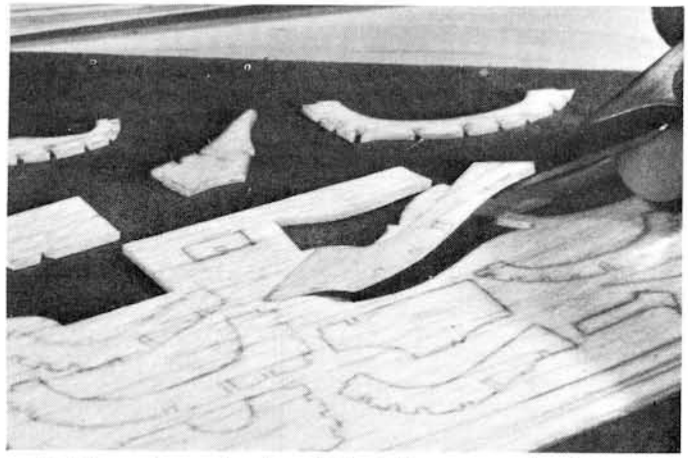

1/32 SHEET
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
1/32 SHEET
A
B
C
D
E
F
G
H
1
2
3
4


1/16 DOWEL
OFFSET FIN 1/32 TO 1/16
FOR LEFT TURN
FILLET
1/16 SHEET
E 3
1
2
2
1 3/8'' DIHEDRAL
1
1
1
E-1
2
E-2
1
2
1/32 SHEET

P-51



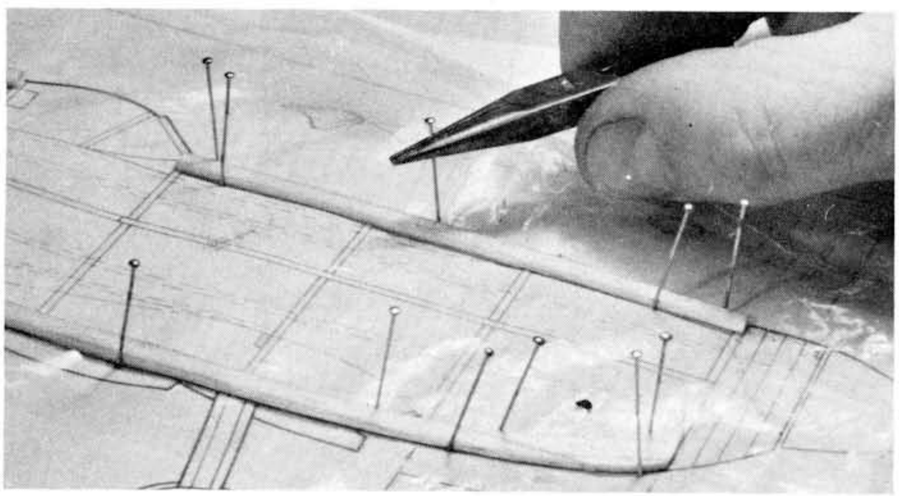
1. Place a piece of carbon paper over a sheet of balsa wood of the thickness specified on the parts layout being used. Position the layout carefully over the sheet and pin it in place. Trace the outlines accurately, using a medium hard pencil.



2. Using a sharp-pointed modelling knife, cut around each component piece and remove the small stringer slots afterwards. For uniformity of this last operation, it may be found easier to use a Swiss file of the appropriate width.

# Building and Finishing

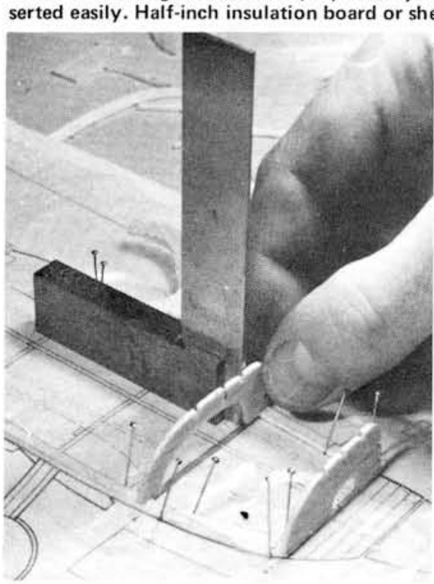
By J. D. McHARD



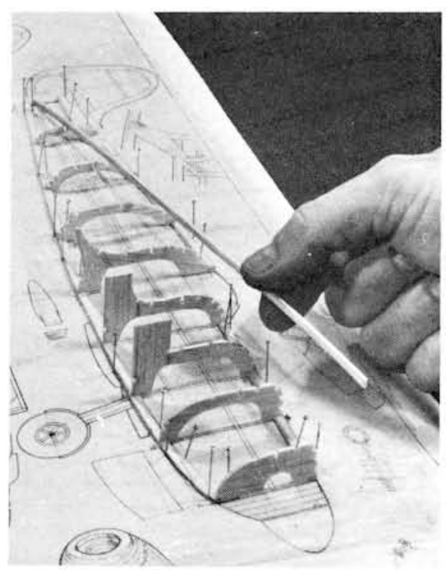
3. Glue the keel pieces together where necessary and position them over the fuselage side view, after first of all covering the plan with a sheet of thin transparent polyethelene to prevent the glue from sticking to it. Pins holding the keel pieces in place should be positioned on either side of the wood and never stuck through it. Ensure that the building surface over which the fuselage is assembled, is perfectly flat and soft enough to enable the pins to be inserted easily. Half-inch insulation board or sheet balsa is suitable for these small models.

Having completed the airframe a decision has now to be made on whether we are going for maximum flying performance or maximum realism. Much as one would like to have both, it is unfortunately not possible. The achievement of a high degree of realism inevitably involves the addition of weight, and no matter how little additional weight is added, the performance will undoubtedly be decreased.

If you really want high duration from a rubber powered model then you must forgo color dope. However, it is possible to achieve an acceptable performance and high degree of realism provided one is aware of the fact that weight is so critical and that a certain amount of time must be spent in developing the art and skill of applying a lightweight color finish by use of an air brush such as the Badger 100 or the De-Vilbiss as used by artists and photographic re-

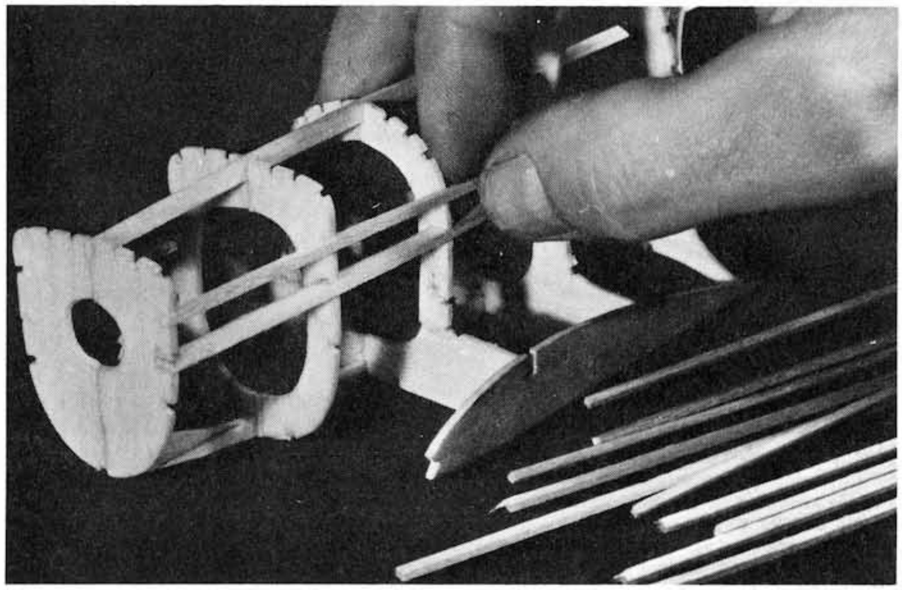


4. (Left) Glue the half-formers in position over the plan, using a set-square to ensure that they are perfectly vertical.

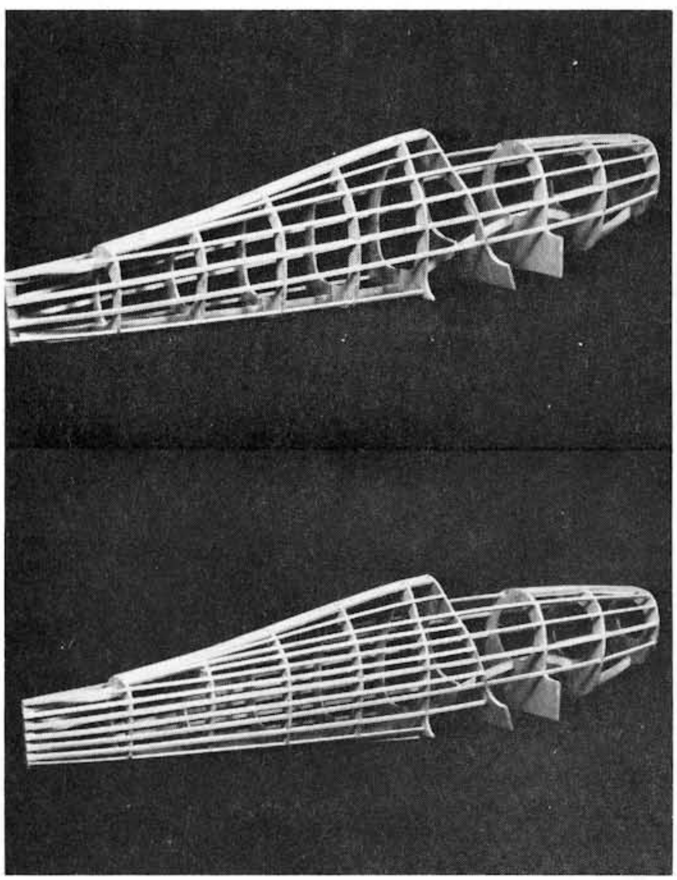


5. (Right) When all half-formers are in position and the glue has set, stick the side keel in place, checking that the half-formers remain perfectly upright and adjusting the side keel slots if necessary, to ensure a perfectly straight line is maintained from front former to tail post.

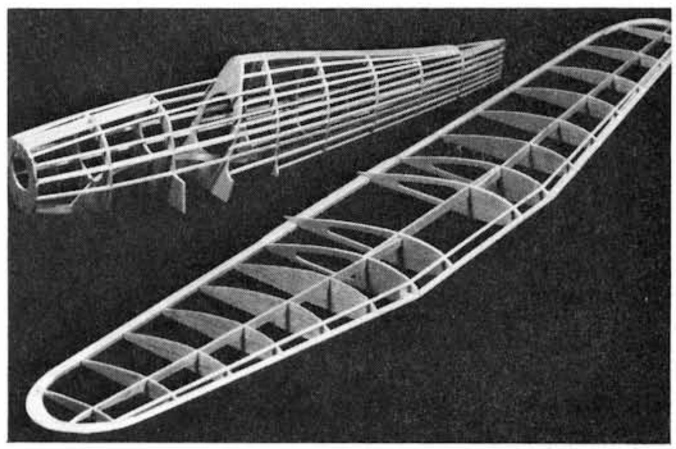

6. When dry, remove the construction from the plan and glue in place the opposite halves of the formers, carefully lining them up and ensuring absolute "squareness."
Titebond Glue is recommended for all constructional work with balsa wood. It can be diluted slightly with water if desired.



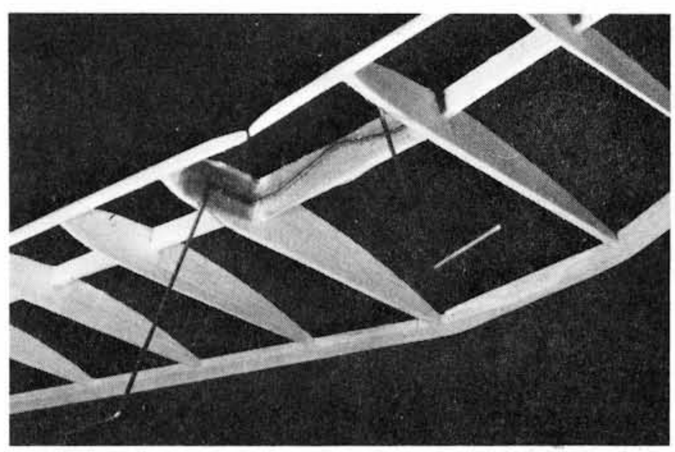
7. After positioning the second side keel, the 1/16th sq. stringers are placed in their slots, ensuring that they form perfectly smooth runs from front to back. Fix the stringers alternately . . . one to the left side and then one to the right side of the fuselage, to reduce the possibility of distorting the framework. Use a pin or a sharp-pointed piece of 1/16th sq. to apply the glue in the stringer slots.



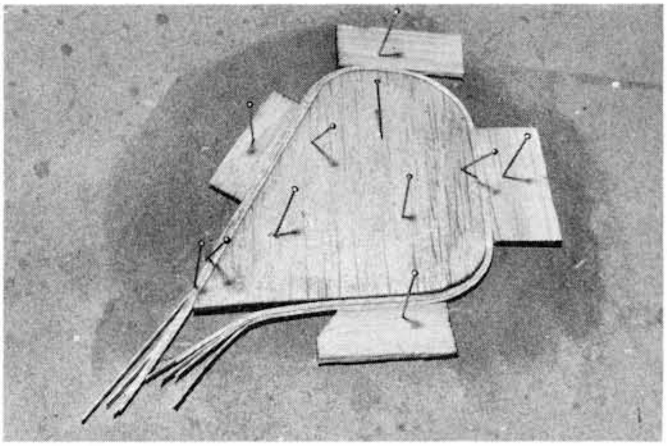
8. Here is the completed fuselage basic structure. Check it carefully to ensure that no warps have accidentally been built into the structure, and carefully sandpaper the whole assembly to remove any rough spots which would prevent a smooth covering job to be carried out later.

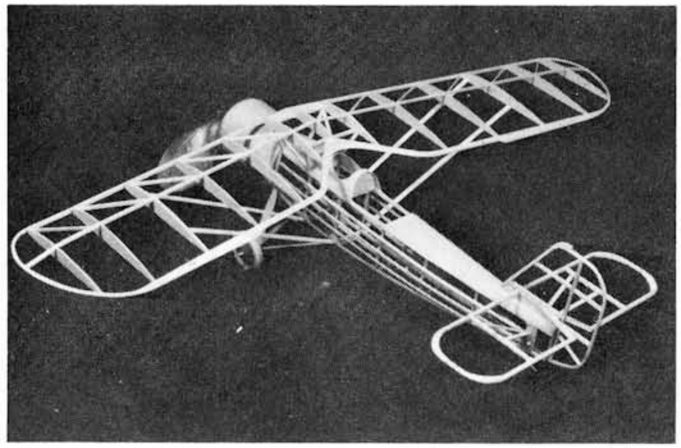


9. The wing and tail are built over the plan in the same way as the fuselage. Construction of these components varies in detail from model to model, and variations are explained in greater detail in the articles and plans of the individual models.



10. Landing gear wires can be attached very efficiently to the airframe by means of silk or nylon patches saturated with quick-drying epoxy glue.





### LAMINATED OUTLINE CONSTRUCTION

Wing tip and tailplane outlines may be either built up from separate sections as shown on the plans in this book or they may be formed from laminated strips.

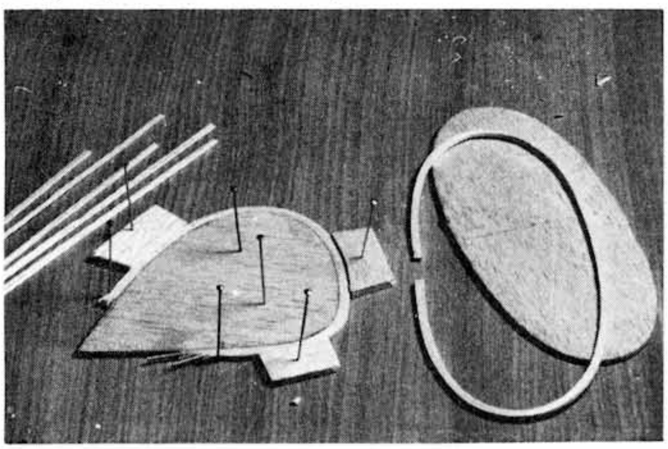
Although perhaps a little more time is needed to produce a laminated outline, it is certainly a very neat form of construction and if properly done, it results in a resilient, strong but very light construction.

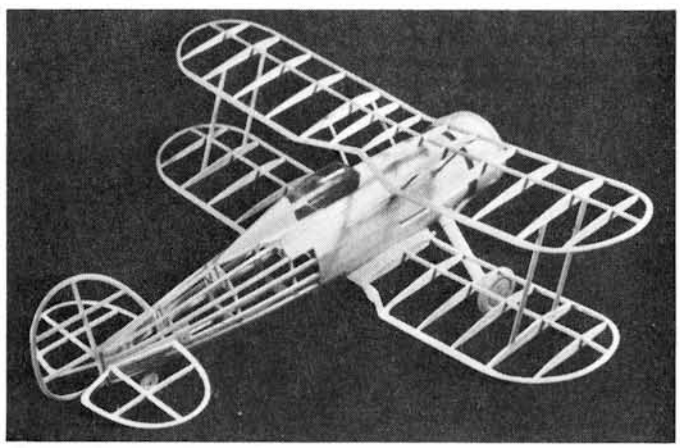
The method is really quite simple. First of all, a template must be cut from 1/8 sheet balsa approximately 1/16 in. smaller all around than the outline of the finished component. This is waxed around its edge using an ordinary candle and pinned down to a waxed surface or to a flat plastic film covered surface. Five strips 1/16 in. wide are now cut from a sheet of 1/64 balsa. They should be long enough to go around the whole template with about an inch to spare at each end.

These strips should be soaked in a solution of P.V.A. white glue and water of a cream-like consistency until completely saturated. They are then pressed together and carefully formed around the template, being careful to maintain every piece in contact with the next one and holding it firmly in place by means of small pieces of 1/16 sheet each held with a pin as shown.

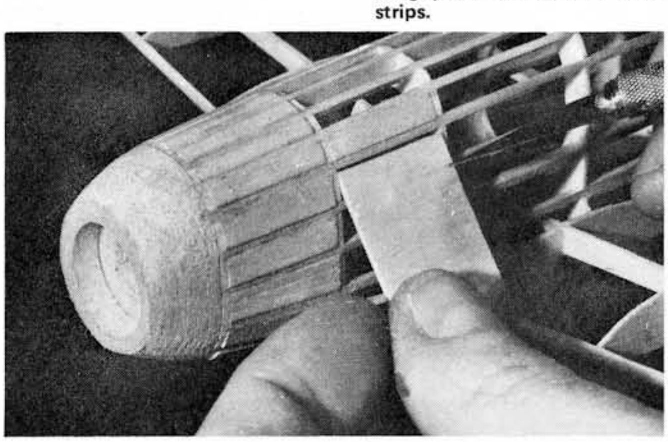
Allow to dry thoroughly and then remove carefully from the template, cut to size and glue in place, overlapping the members to which it is attached with a scarf joint.

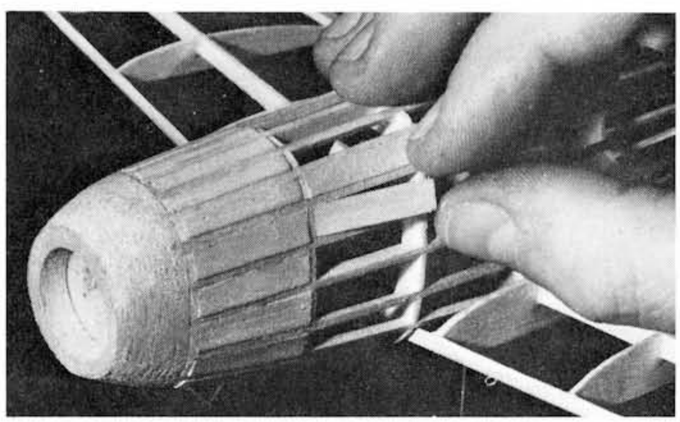
The constructional photograph shows a fin and rudder outline being made in the way described above and the airframe picture shows the completed component in place on a Heinkel He. 46. The wing tips of this model are also constructed in this manner.





The outlines of the complete tailplane components, and all the wingtips of the Gladiator are formed from laminated 1/64 x 1/16 strips.

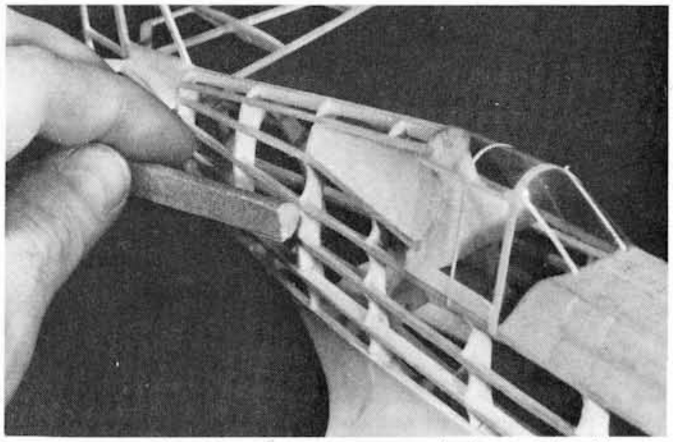




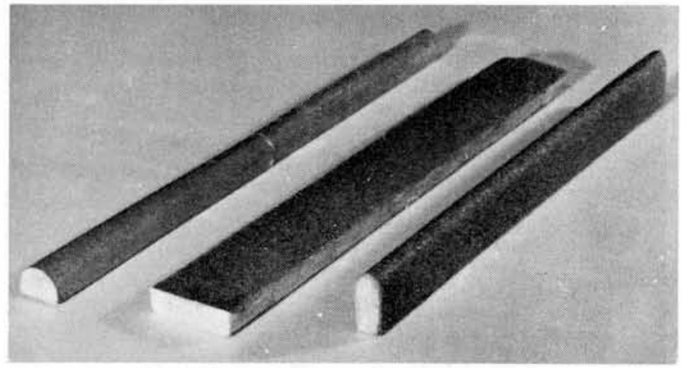
11. Filling in the nose with pieces of 1/16th sheet needs a certain amount of care but is well worth the effort involved. You need the weight in the nose and the in-filling increases the strength of the model enormously in addition to producing a beautifully smooth and realistic structure.

Cut a piece of 1/16th sheet to the correct width between two formers with the grain running along the length of the fuselage. Offer it up to a stringer and sand the edge until a neat fit is achieved. Lightly "nick" the sheet to indicate the width to which the insert must be cut to exactly fill the space between two stringers.

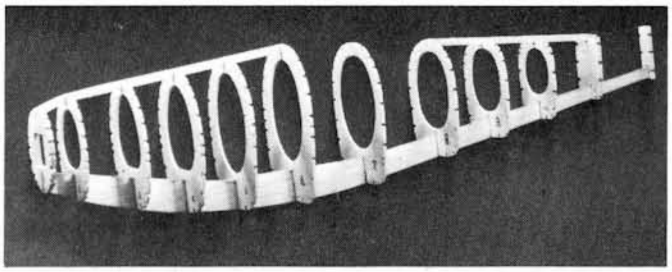
12. Using a steel straightedge cut between the two "nicks" and check the resulting insert for fit. Try to make the cut in such a way that each little panel is slightly oversize so that by careful sanding it can be made to fit exactly without leaving gaps in the structure. Note that the inserts are edged with glue before finally pressing into place. As can be seen in the photograph, each insert is allowed to stand very slightly "proud" of the stringer surface so that proper curvature can be introduced when the nose is finally sanded down.

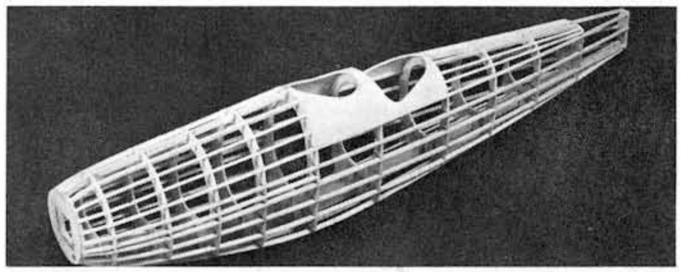


13. After assembling the various components, the formers should be relieved slightly between the stringers wherever tissue covering is to be applied. This is most easily accomplished by the use of a half-round piece of 1/4" x 1/4" balsa around which a strip of fine sandpaper has been glued.



14. A good finish depends very much upon accurate workmanship and the careful use of sandpaper to achieve a regular and smooth structure prior to covering. Sandpaper used "loose" in the hand is a very poor tool. Time spent in preparing a selection of "sanding sticks" is well worthwhile. Here is a selection of three shapes . . . you will think of many others. Make a selection of each shape and cover them with different grades of sandpaper. In some cases you can use a different grade on each side of the same stick.





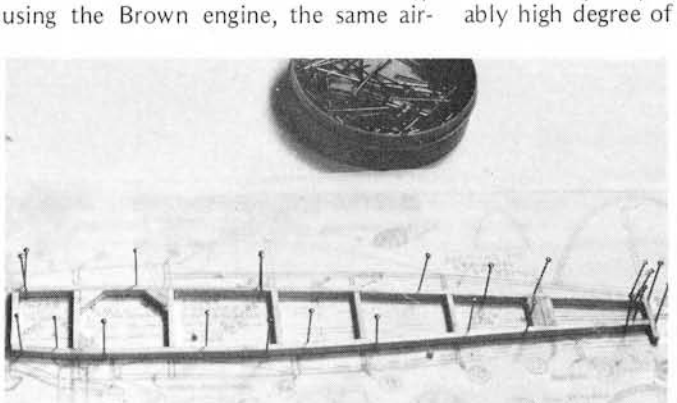
KEEL FUSELAGE CONSTRUCTION
Another method of building fuselages is by the "keel-and-former" system.
A deep 1/16 sheet balsa lower keel acts as a built-in jig onto which the complete formers are slotted. They are positioned upright by a smaller section upper keel before placing the stringers in position in pairs . . . one on either side of the fuselage at the same time in order to avoid distortion.

touchers.

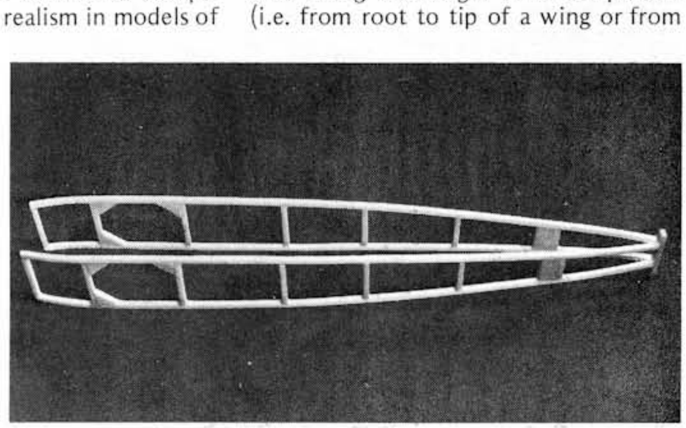
It is, of course, possible to get high performance from a fully decorated model by disposing with the rubber motor and using instead one of the remarkable little Brown $CO_2$ engines. Details of a typical conversion are shown on the Spitfire drawing and this principle can be adapted to other models in this book. As a rubber-powered model, the Spitfire would stay aloft for about half a minute maximum. By using the Brown engine, the same airframe will now remain airborne for upwards of 1-1/2 minutes, and despite its complete decoration the all-up weight has been reduced by about 1/4 oz., which has significantly improved the glide. My own philosophy is to attempt to achieve, within an acceptable maximum weight, the highest possible degree of realism, and I accept a performance drop providing the flight pattern is realistic, stable, and consistent.

The only way to achieve an acceptably high degree of realism in models of this size is to employ an air brush and apply the lightest of coats possible . . . just sufficient to produce an opaque tissue surface.

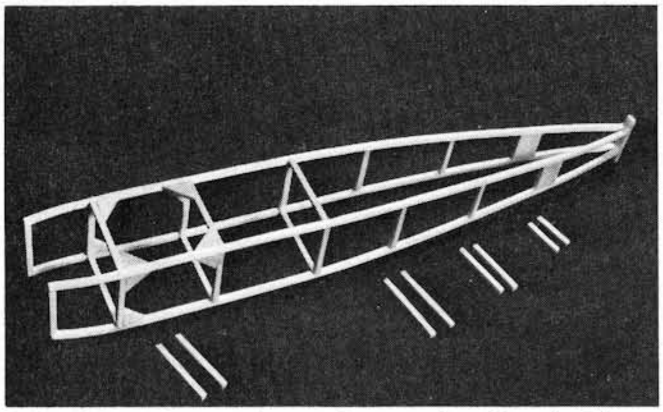
The series of photographs in this article illustrate covering techniques which I employ when applying Japanese tissue. This material is not only exceptionally light in weight, but is very smooth and has a distinctive grain which should always be arranged so that it runs along the length of a component (i.e. from root to tip of a wing or from



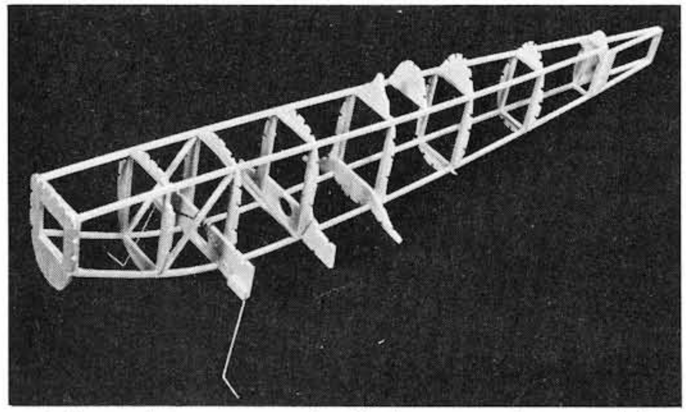
BOX FUSELAGE CONSTRUCTION:
1. Cover the plan with a thin plastic film sheet and lay down the main longerons, holding them in place with pins placed on either side, not THROUGH them. Glue the upright members in place between the top and bottom longerons. Build a second side directly on top of the first one and this will ensure absolute uniformity. Remove the pins, lift the two sides when completely dry and separate them carefully with a razor blade.



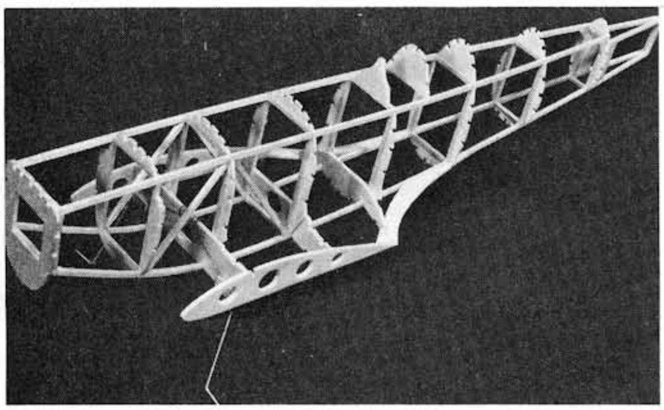
2. Carefully bend the completed sides to conform to the correct line in plan view. Use steam from a boiling kettle if a sharp bend is required. Now glue the sides together at the stern posts.



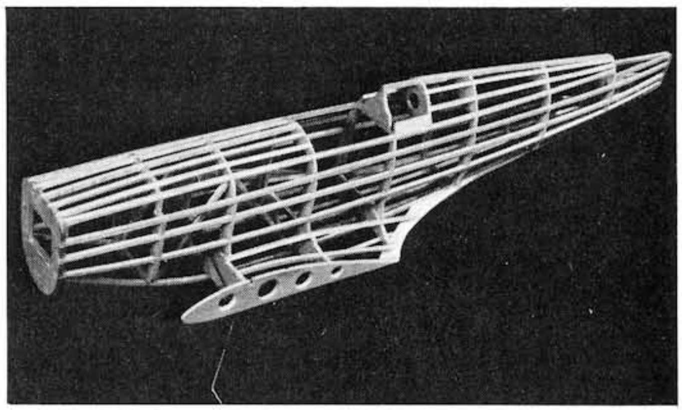
3. Carefully cut the cross pieces to the correct length in pairs. Glue the longest ones in place holding the fuselage sides together with a thin rubber band if necessary. When dry, insert the remainder of the cross pieces ensuring that the complete structure is kept perfectly "square" in cross section.



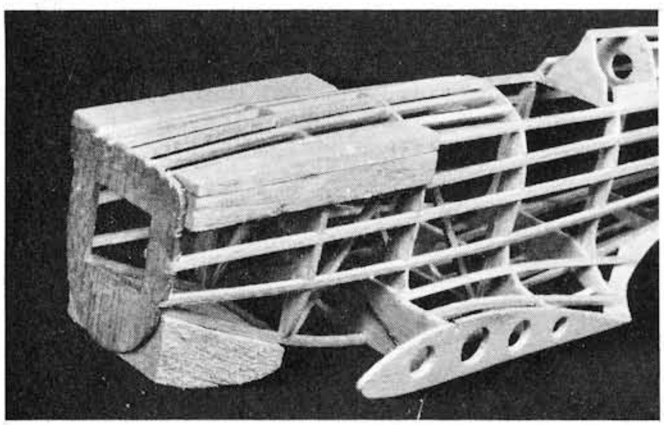
4. Quarter formers are now glued in place on top, bottom and sides of the completed box. Except in the nose, where strength is essential and weight not so important, these quarter formers can be of very light material. In the case of models of the size in this book, 1/16 sq. balsa is used for the basic box, and for the stressed formers 1/16 sheet is used. For the remainder of the quarter formers, 1/32 sheet is adequate.



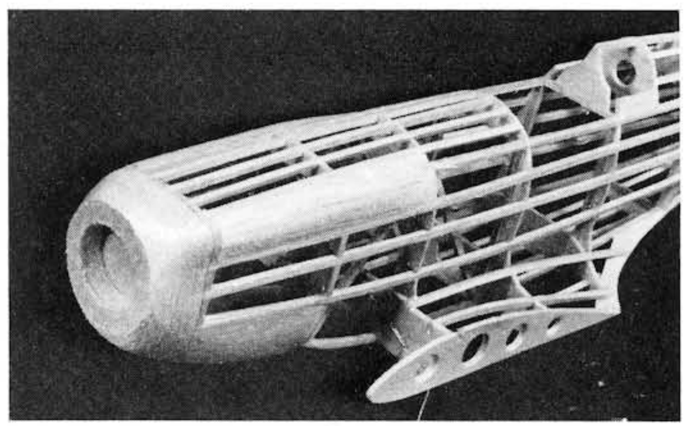
5. In the case of a Spitfire fuselage constructed in this manner, it is best to build in the wing root with the basic fuselage. If glue is used sparingly and wood is carefully chosen, a very strong and light airframe results. Note that the box longerons now form four of the fuselage stringers.



6. Next, 1/16 sq. stringers are added in the same sequence as for a half shell constructed fuselage.



7. Where blocks may be required to achieve a nose contour, these should be glued in place and carved and sanded to shape "in situ."



8. The engine cylinder head fairings may, on the Spitfire, be made from block balsa as shown here or, with the stringer formation possible with the half shell fuselage shown in the plans, 1/16 balsa inserts may be used.

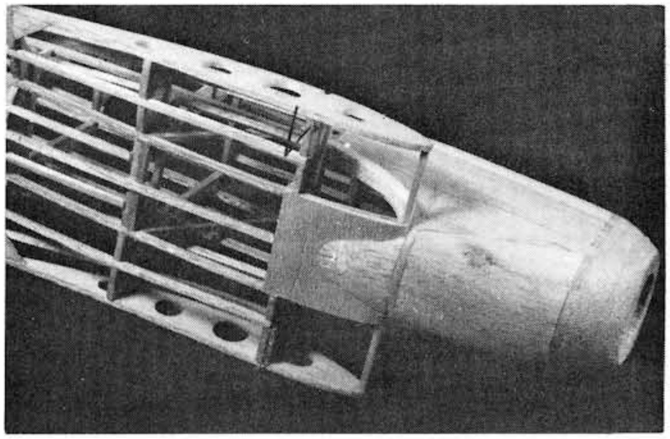
nose to tail of the fuselage). It also has a very low absorbancy and consequently soaks up a relatively small amount of dope, thereby saving quite a lot of weight.

Having attached to the airframe all the tissue covering as shown in the accompanying photographs, the tissue must be tightened before applying clear shrinking dope. The gentlest method of tightening tissue is to hold it in the steam from a boiling kettle. A considerably amount of control can be exercised over the degree of shrinkage achieved by this method, which is particularly suitable for lightweight airframes.

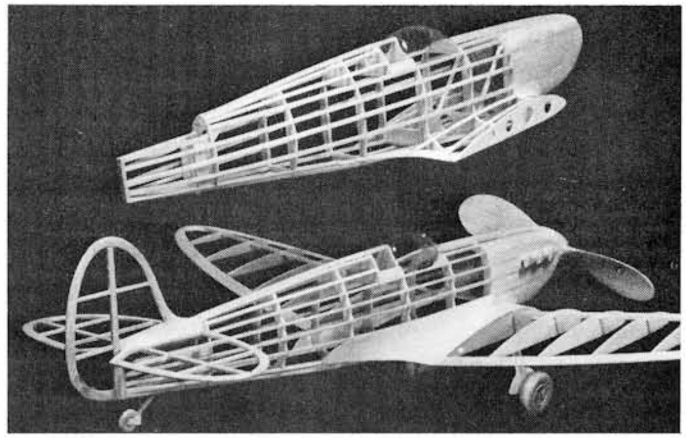
Where the strength of the airframe permits, most people prefer to water shrink the tissue by means of spraying it with a mist of warm water, either from a perfume spray or with the air brush. Always allow the moistened tissue to dry naturally at room temperature and do not attempt to accelerate this process by holding the model near a radiator or other heat source.

When the tissue has completely dried out, it will be found to be entirely smooth and wrinkle-free. It is now ready for clear doping.

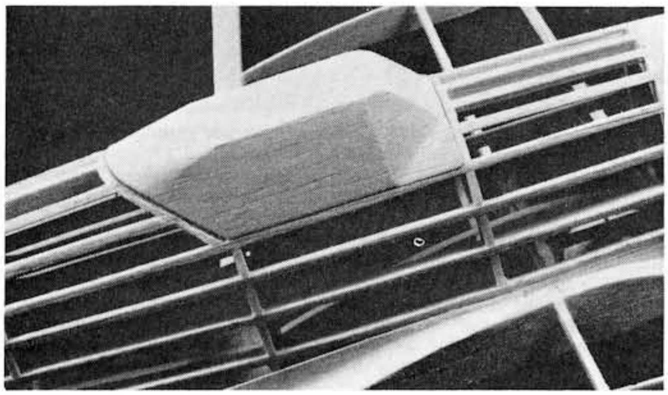
My own preference is cellulose acetate or cellulose nitrate dopes for



9. After fitting the remainder of the nose filler inserts, the complete section should be sanded smooth to blend in cleanly with the nose block. This photograph also shows how the underside of the fuselage nose may be blended into the wing leading edge using 1/64 sheet balsa on the wing and very soft 1/8 sheet for the tongue shaped fairing piece.

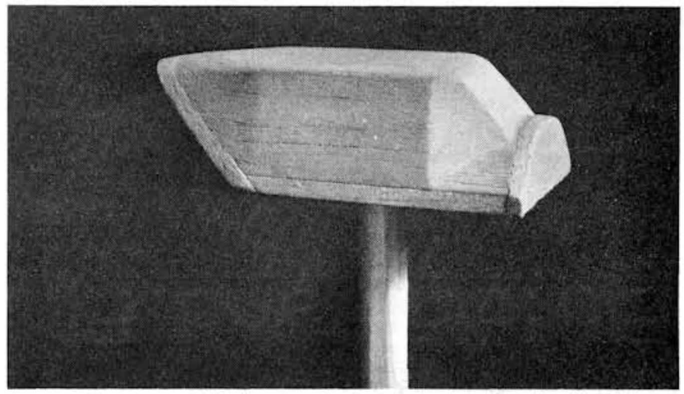


10. Shown here is the completed Spitfire built according to the book plans (bottom). Above it, is shown the same size fuselage constructed by the box method. Although somewhat more tedious to build, the box-built fuselage can be significantly lighter and stronger than the equivalent conventional half shell job.

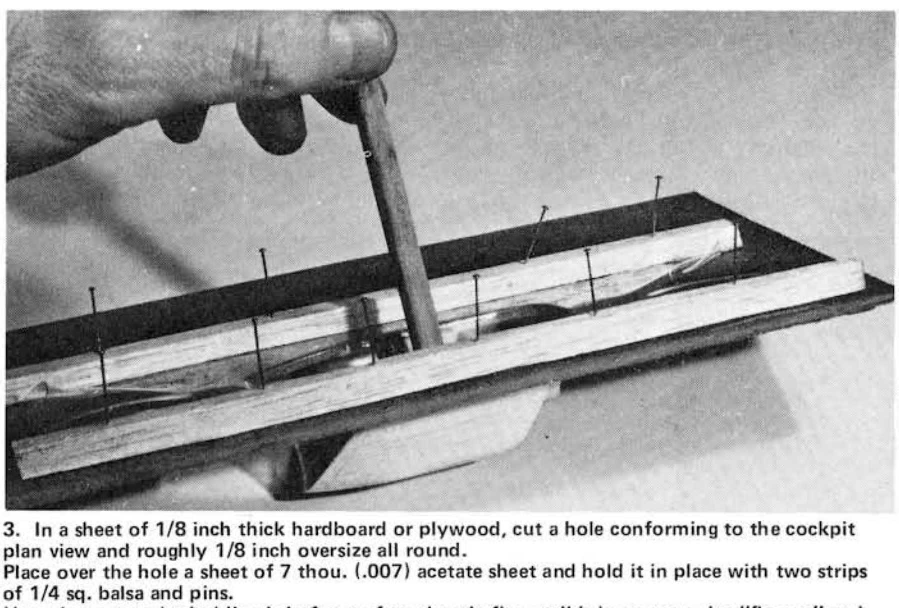


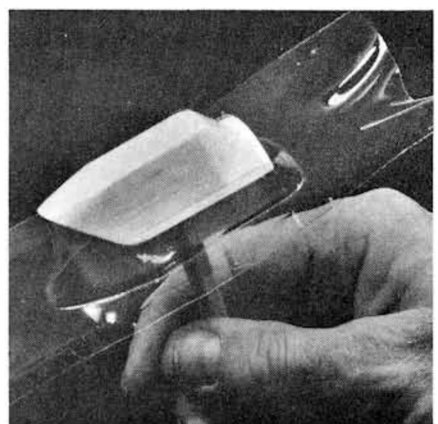
CANOPY MOULDING

1. Carefully carve a block of balsa to the shape of the finished cockpit canopy so that it fits neatly into the cockpit area.

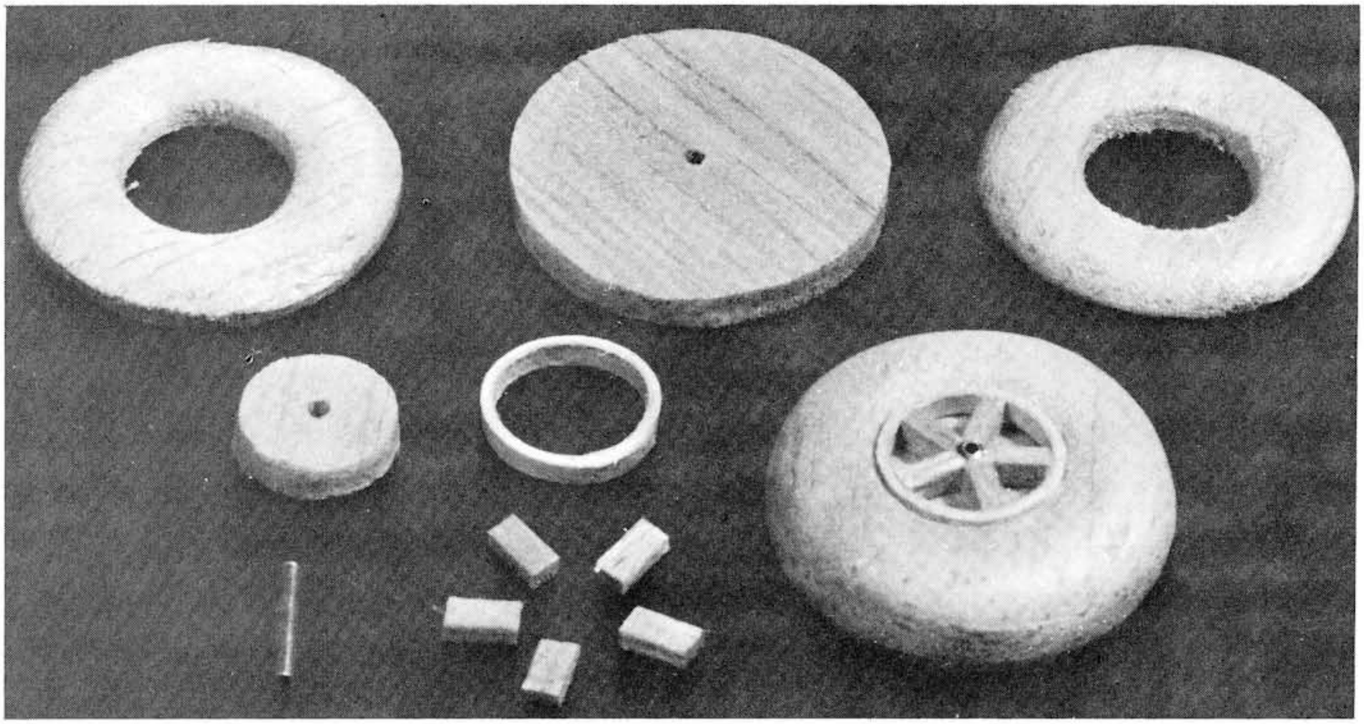


2. Add pieces of 1/8 sheet to the front, back and underside of the canopy block and blend them into the correct section. When dry, pierce the underside of the block and insert a 6 inch length of 1/4 inch diameter dowel.






3. In a sheet of 1/8 inch thick hardboard or plywood, cut a hole conforming to the cockpit plan view and roughly 1/8 inch oversize all round.
Place over the hole a sheet of 7 thou. (.007) acetate sheet and hold it in place with two strips of 1/4 sq. balsa and pins.
Heat the acetate by holding it in front of an electric fire until it becomes quite "floppy" and begins to give off a little steam.
At this point the balsa canopy form must be instantly plunged into the cut out hole, carrying the acetate down and forming it into a transparent canopy. Hold it still for a few seconds unti the acetate cools.
4. Remove the pins and lift the moulding clear. It can be trimmed to shape using a pair of small scissors allowing about 1/16 inch overlap to stick to the model.
A white or milky appearance on the moulding indicates that the acetate was insufficiently heated or was allowed to cool too much when the balsa form was pressed into it.
5. The neatest method of fixing the canopy is to hold it in position with a strip of adhesive tape and then run some clear dope around the edge of it. Allow the dope to dry completely before removing the tape.



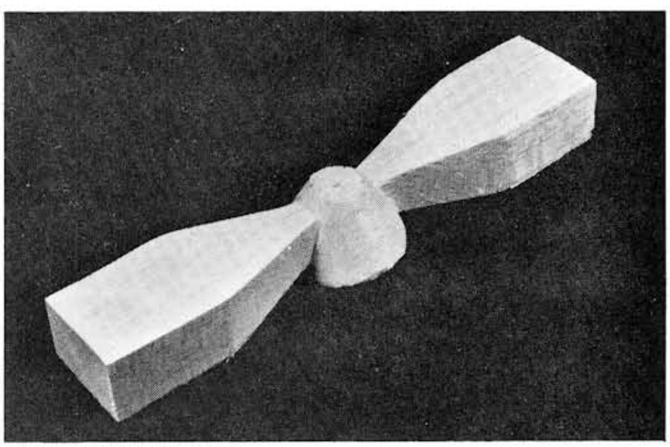
BALSA WHEELS
Very lightweight, realistic wheels can be easily constructed in the following manner:
1. Cut three discs of balsa which, when laminated will equal the thickness of the finished wheel.
2. Cut out the centers of two of the discs and sand one face of each resulting ring to a half-round section on one side only.
3. Glue these three pieces together, ensuring that the grain directions are crossed.
4. The hub construction will vary from model to model, but a typical cast spoke type hub such as used on the Spitfire, Hurricane and ME 109 is illustrated. A 1/16 thick paper ring is formed around a suitable circular former by taking a 1/16 wide strip of stiff paper about 4 inches long, soaking it with balsa cement and winding it around the former and holding the end in position until the cement starts to set.
5. The paper ring just formed is placed in position on one side of the wheel and a balsa disc is glued to the opposite side to represent the brake drum.
6. A short length of brass or aluminum tube is now placed centrally through the wheel and fixed the Epoxy glue.
7. "Spokes" are now cut to length from 1/16 strip, placed in position around the tube, and glued in place with Titebond.
8. When the whole thing is dry, the wheel should be checked for concentricity by spinning it on a pin. The perimeter should be sanded to achieve a tire profile and then the entire wheel is given two coats of sanding sealer. When dry, it is lightly rubbed down with fine abrasive paper prior to painting.

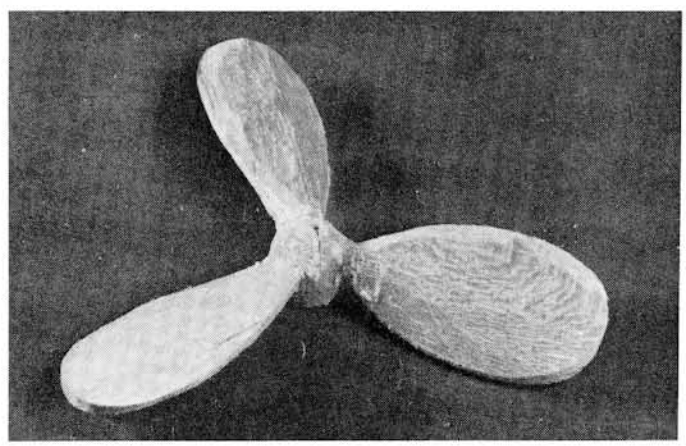
finishing. It is important to ensure that all dopes used are of a similar type; that is to say, you must avoid mixing, for instance, butyrate with nitrate or acetate, and also, keep nitrate and acetate well apart.

Using a 1/4 inch flat camel hair brush, apply to the water shrunk tissue two coats of clear shrinking dope diluted with the appropriate thinners to the consistency of thin cream. It is impossible to give precise proportions of dope to thinners since there is so much variation in the consistency of different makes of dope.

When dry, very lightly and carefully go over the airframe with a piece of No. 600 grit wet-or-dry abrasive paper to remove any roughness which occasionally appears on the tissue surface after the application of clear dope. When you are satisfied that the whole model model is smooth as it can be made, you may apply the color dope. Never under any circumstances apply this with a brush because the additional weight almost inseparable from such application will severely reduce flight performance.

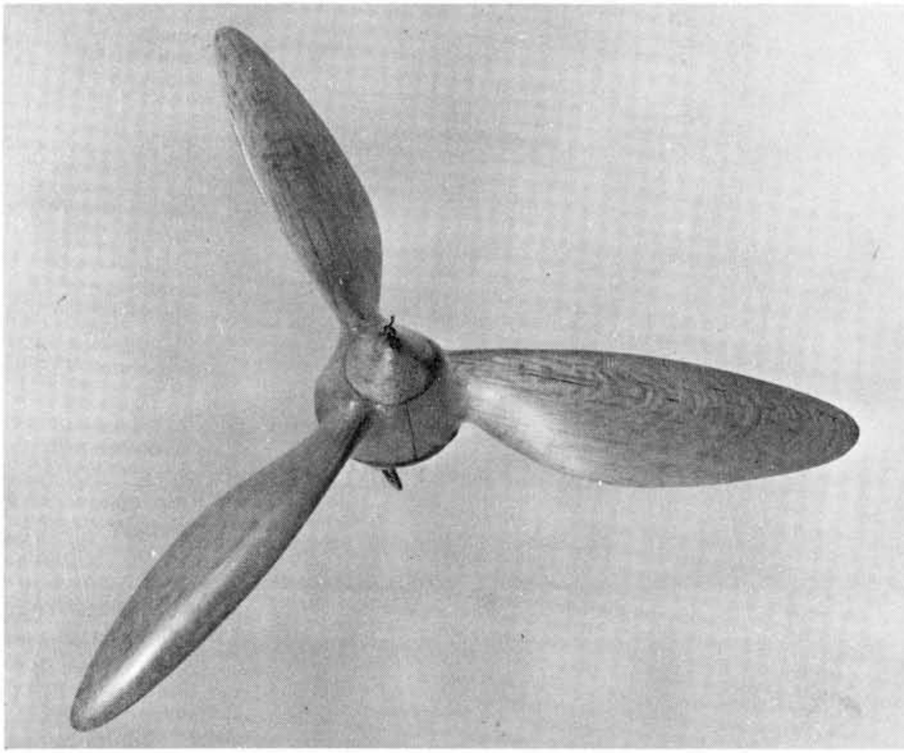
Color dopes used with the air brush should be once again thinned out to a



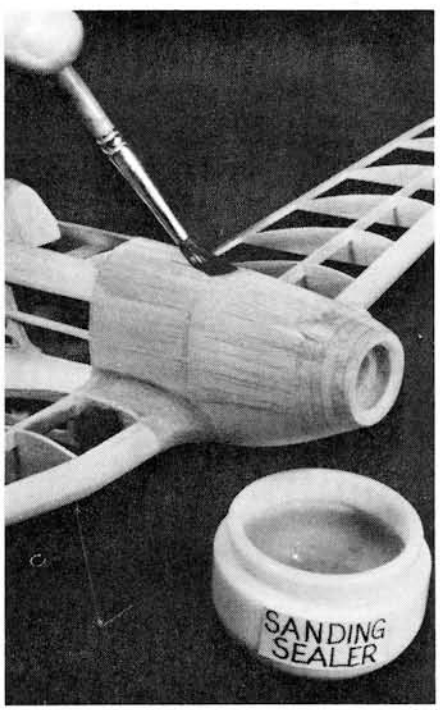


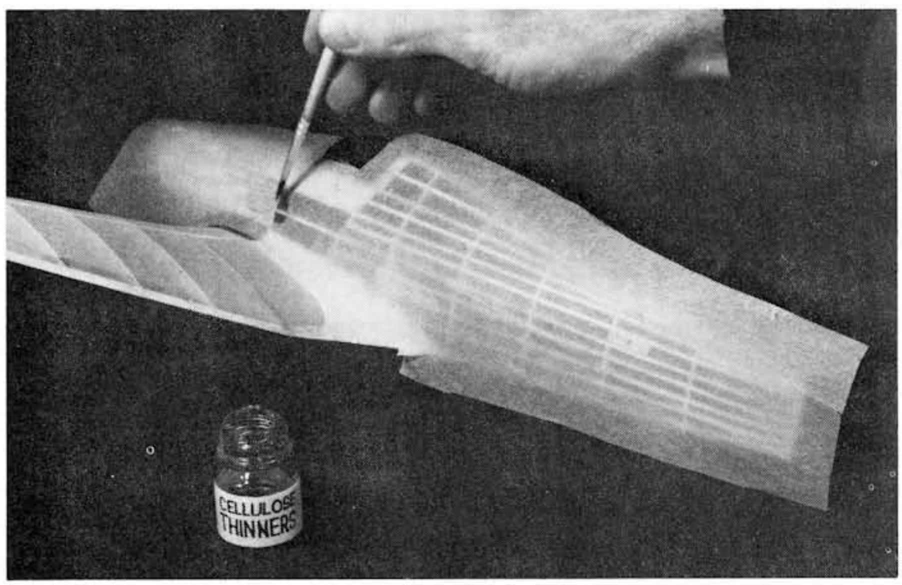
WOODEN PROPELLER
1. Propeller carving is not as difficult as many would have you believe. Success depends upon starting properly with a block of straight grained hard balsa and cutting the propeller blank exactly to the shape shown in the drawings.
The spinner is best carved from the same block as shown. Drill a 1/16 hole through the center of the block and ensure that it is perfectly "square" with the propeller faces before proceeding further.

2. Rough-carve the blades, using the edges of the blank as a guide. Carve the front face first and then the rear face, leaving the blades thicker at the hub than at the tip.
In the case of a three bladed propeller, the individual blades should be joined at the hub using epoxy adhesive and reinforcing the joint with a plywood disc at front and back.

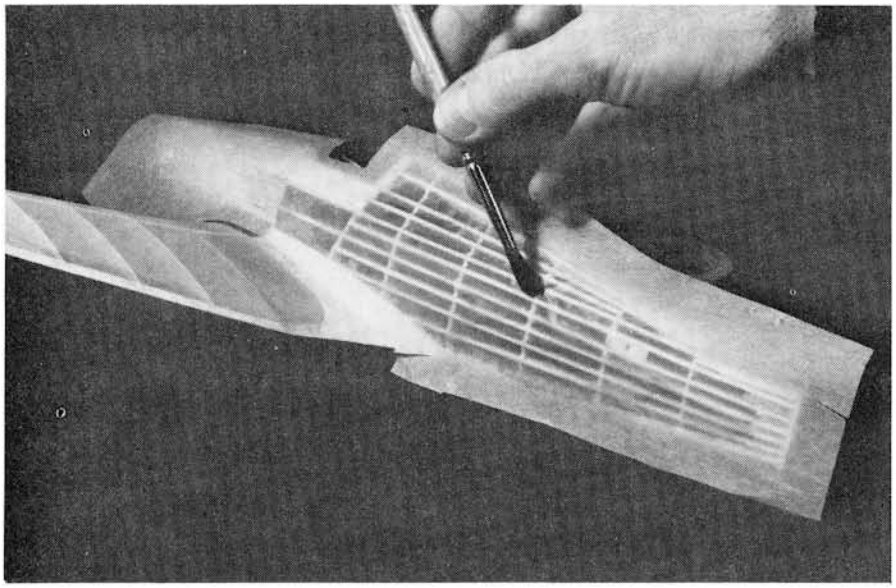


3. Sand the propeller to shape with coarse sandpaper and undercamber the rear blade faces. Use progressively finer sandpaper until a fine finish is achieved. A brass tube should be epoxied through the hub and the propeller balanced by pivoting it on a piece of suitable wire.
Finally, three or four coats of sanding sealer should be applied and rubbed down to achieve a grain-free surface prior to spraying matt black.
Various free-wheeling systems are shown on the plans in this book.




15. When the airframe is complete, give it a coat of sanding sealer on all the surfaces which are either to be painted or covered with tissue (not, for instance on the inside faces of the formers or ribs - only on the outside edges). Two coats of sealer should be given to the nose. Note the two small cowling bumps on the Hurricane nose shown in this picture. They are made and shaped from soft 1/16th balsa and attached prior to applying the sanding sealer. Larger projections . . . such as exhaust pipes . . . are made and checked for fit at this stage, but not finally glued in place until after the covering is complete.
If a proprietary brand of sanding sealer is not available locally a passable substitute can be produced with very fine talcum powder in clear dope.
The airframe, now with a coat of sanding sealer on its outside surfaces, is lightly sanded with very fine paper only sufficiently to remove the slight "fur" which the sealer raises on the wood.
Using Japanese tissue, a panel is cut to size leaving approximately 3/4 inch all around oversize Semi-wet covering produces the neatest results although a certain amount of skill is required before perfect results can be achieved. The following photographs illustrate the technique.
16. Attach the tissue at the point shown at the rear of the sheeted nose area using cellulose thinners which will, on soaking through the tissue, activate the sanding sealer and when dry the tissue will be firmly attached to the wood. The advantage of using this method is that should a mistake be made, the covering can be lifted without damage simply by re-soaking with thinners.

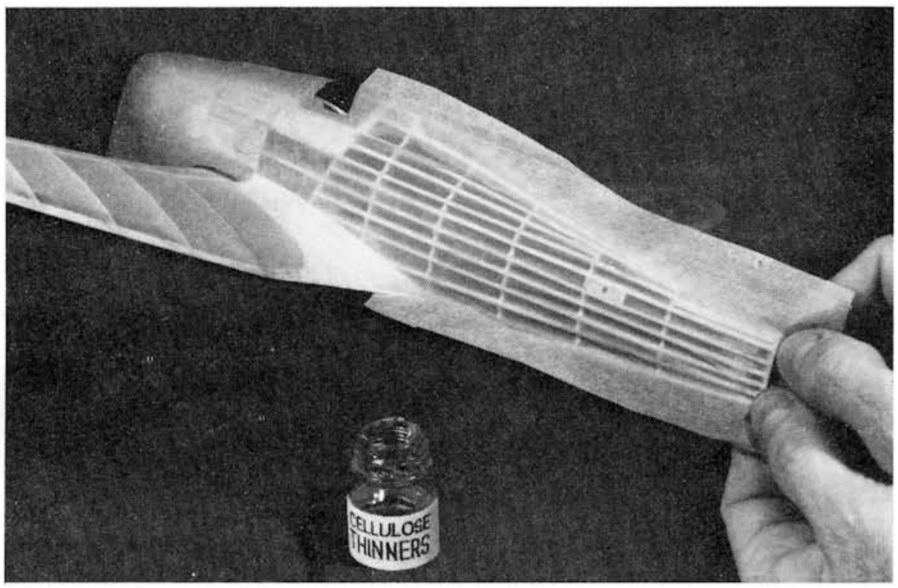


**17. Take a soft camel brush . . . about a No. 4 or 5 . . . load it with water and carefully moisten the tissue aft of the attachment point but leaving the edges and extreme tail dry where they will be attached to the frame. Moistening the tissue in this way expands it and allows it to conform to a compound curved surface.**

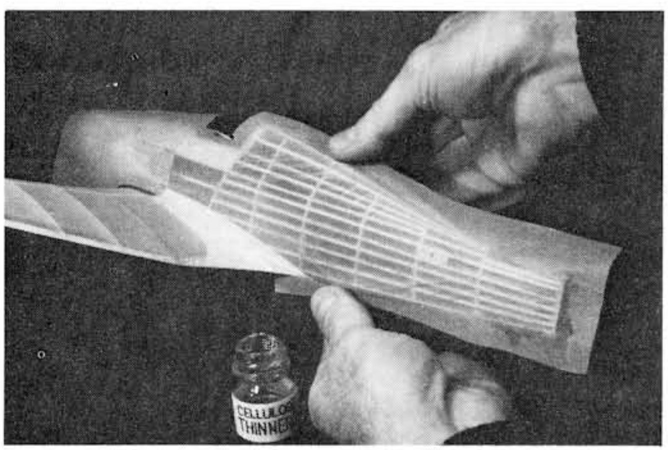
fairly watery consistency. Spraying should normally be done at between 3 and 6 inches from the model and this is shown in one of the accompanying photographs. Try to develop a spraying technique which allows the dope to dry almost as soon as it hits the model. If the dope is too thin it will tend to run and the coverage will be very poor. If, on the other hand, it is too thick you will get an "orange peel" reticulated surface and, more important, a lot of unnecessary weight. Only by practice can a good technique be developed.

It is not easy to obtain ready mixed camouflage colors in cellulose based dopes. At one time, every model shop shop carried a very wide range of such material but today it has almost entirely disappeared.

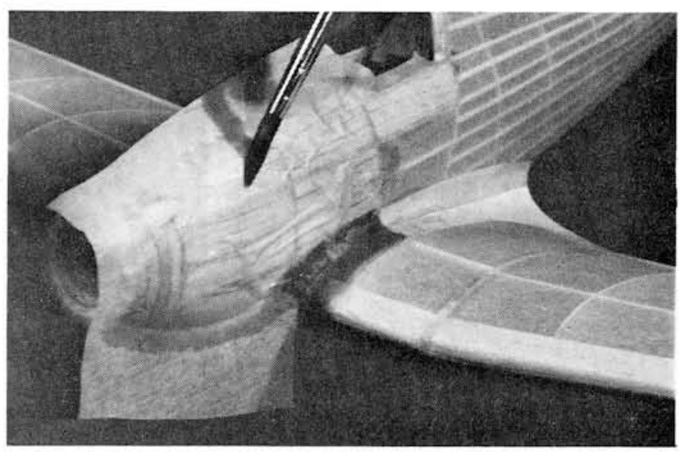
British camouflage dark earth and dark green are still bottled by the Titanine Company in England in both glossy and semi-matt finish. The latter is a really first class material and highly recommended. It is unfortunate that other colors are not available in this range. Two oz. bottles can be obtained from Messrs. Henry J. Nichols & Son Ltd., 308 Holloway Road, London, N7, 6NP, England.



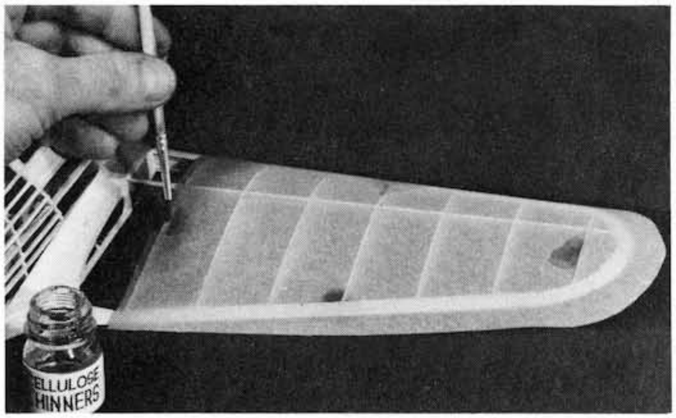

**18. Gently ease the tissue back at the tail-post stretching it only sufficiently to enable the tissue to form itself round the fuselage contours without wrinkling. The correct tension thus applied can only be learned by trial and error. Now attach the tissue to the tail-post with thinners, holding the tension on the tissue until it is firmly fixed.**



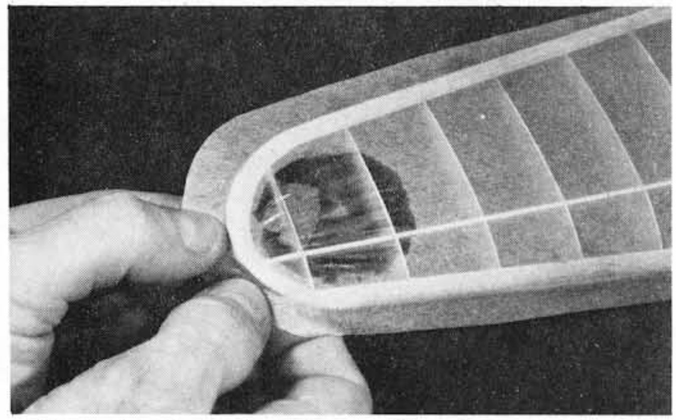
**19. If the tissue has started to dry out, re-moisten it. Now gently ease the tissue in the manner shown, approximately mid-way between the fore and aft attachment points, sticking it to the upper and lower keels with a spot of thinners just about where the thumbs are in the picture. When secure, run thinners along the remaining edges, gently easing out any wrinkles as you go.**



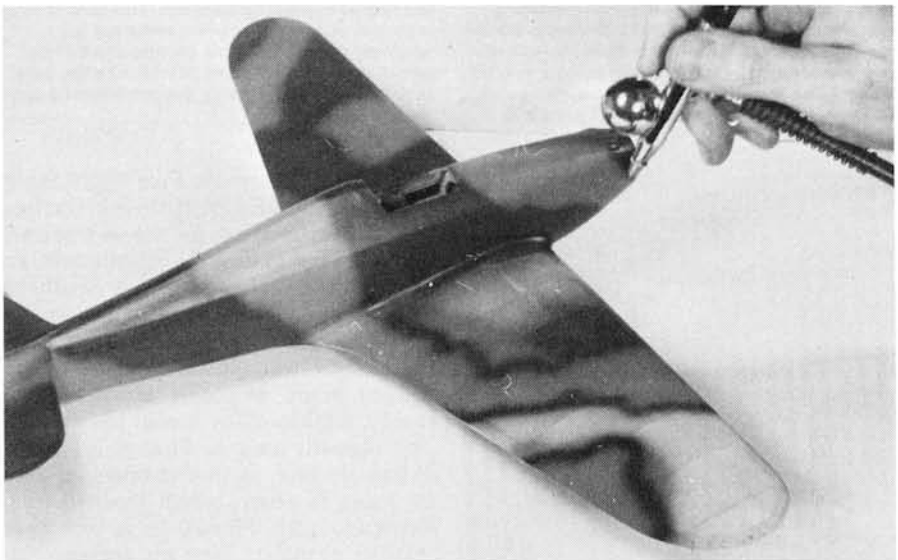
**20. Moisten the tissue over the sheeted nose area, with water. Gently smooth it down to remove the wrinkles and press it carefully over cowling fairings etc. Now flood the whole area with cellulose thinners while the tissue is still wet. There is no need to press it in place after this process, and as the water drys out, the tissue will be found to have bonded itself very securely to the wooden surface. Any "blushing" which takes place will disappear when sanding sealer is applied over the tissue in these sheeted areas, and a superb finish will result when the sealer is smoothed with very fine abrasive paper.**

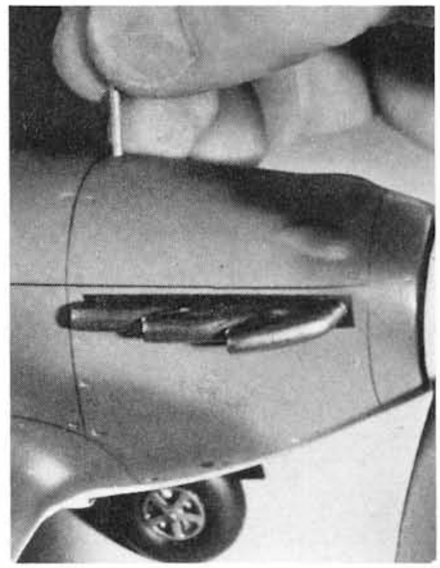


21. Wings are covered "dry" where no compound curvature exists. Attach the tissue with thinners first at the root and then at the tip rib before sticking it to the leading and trailing edges with spots of thinners as shown above.
When these spot attachments are dry, the tissue is gently stretched into the "corners" of the structure and thinners run around the frame to secure it in place.



22. Now lift the tip rib attachment with another spot of thinners and moisten the area where a double covering curvature must be achieved using clean water on a soft camel brush. Leave the edges dry and gently ease the tissue down towards the wingtip outline attaching it with thinners.
All surplus tissue may be trimmed off flush with the structure outline by running one of the fine sanding sticks along the edge at right angles to the surface. Dry-covered areas are now lightly sprayed with water to shrink the tissue prior to doping.

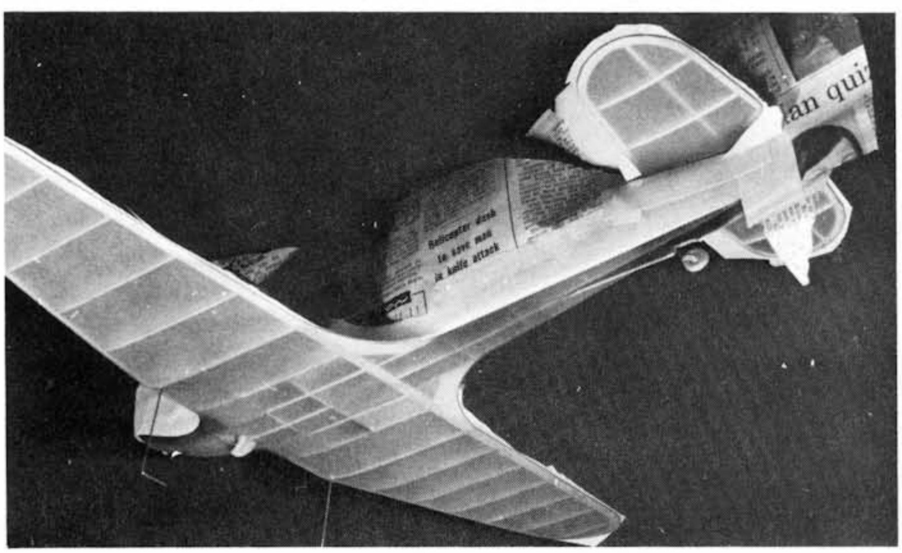




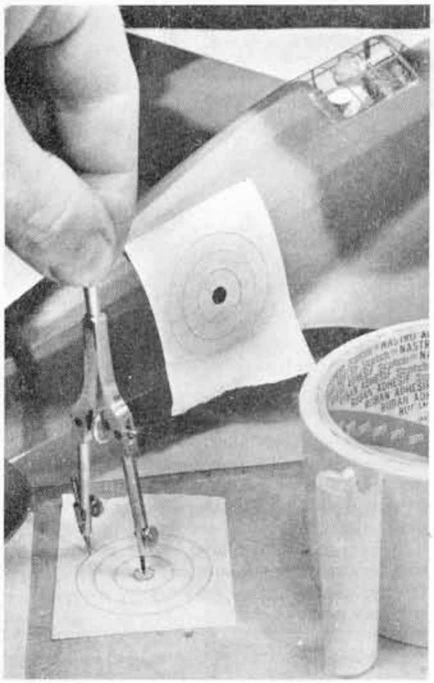
FINISHING

1. When the covering is complete and has been lightly sprayed with water to shrink it, the whole model is given two coats of thin clear shrinking dope. Sheeted areas like the nose are given two further coats of sanding sealer and lightly rubbed down in order to achieve a really smooth and grain-free surface.
A very thin coat of colour dope may now be applied, using the lightest of sprays from an artist's air brush. In the case of a camouflaged model, the outline of the shadow shaded areas are first "drawn in" with the air brush before filling in the colour areas as shown above.

3. (Above) Panel lines may be drawn onto the model using strips of thin plastic as guides for the draftsman's ruling pen, which is charged with dark gray dope.
On sheeted areas, cowling fasteners may be simulated with the sharpened end of a brass tube gently pressed into the surface, at the same time slowly rotating it between thumb and finger as shown.
Exhaust pipes should be painted with a mixture of black and brown matt dope to which has been added a little silver.



2. (Left) Where a sharp dividing line is required between colours, the already doped areas must be protected.
Strips of draftsman's adhesive masking tape are carefully positioned along the colour dividing lines and newspaper is used to shield the painted parts.
After spraying the unmasked areas, the masking tape should be very carefully removed by peeling it gently back on itself. Never lift it from the tissue at right angles or you will run the risk of damaging the surface.



MARKINGS

1. Transfers may, of course, be used whenever these are available, but there is certainly nothing to equal painted lettering and roundels, which are not difficult to produce if the following procedures are followed. Roundels are cut from draftsman's masking tape which is stuck to a sheet of plastic laminate. Use a pair of springbow dividers with one pin sharpened to a knife - edge using a fine oilstone. The resulting circles may then be carefully peeled off the laminate and placed in position on the model.

2. One piece at a time is now removed and the respective colour sprayed. The tape is now replaced and the next piece removed for spraying and so on. This picture shows the completed roundel being revealed as the tape is removed together with the surrounding protective newspaper.

Fernando Ramos is Free Flight Scale editor for MODEL BUILDER Magazine, also newsletter editor for the well known Rockwell International Flightmasters, an all-scale model club located in Southern California, USA. A prolific builder of rubber, gas, and $CO_2$ scale F/F models, he strongly recommends the use of the Floquil brand of paints which are primarily marketed for model railroading. The pigment used in Floquil is ground extremely fine, so that it takes very little paint to cover, which saves weight. Fernando adds Floquil to a very thin mixture of nitrate dope and thinner (50-50) and sprays it on the model. For small parts, such as struts, Floquil is brushed directly on the bare wood, full strength, sanded, and a second coat added. No more is needed because of its excellent filling and hiding qualities. The paint comes in an almost endless variety of colors, though they are listed in railroad terms, such as Roof Brown (close to WW I khaki), Pullman Green (olive drab), etc. Mixing colors will get you most anything you want.

For more hints on the use of Floquil, and model finishing in general, you may write to Fernando at 19361 South Mesa Drive, Villa Park, California 92667, USA.

3. Lettering and other non-circular decoration uses basically the same principle except that the design is first traced onto the surface of the draftsman's tape, the outline being cut with a modelling knife before removal from the plastic laminate.

Before spraying be certain that the edges of the masks are well stuck down to the model to prevent color creep.